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UPPER MINNESOTA RIVER SUBBASINS STUDY (PUBLIC LAW 87-639)

# DRAFT

RECONNAISSANCE STAGE REPORT
(PLAN OF STUDY)



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UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

AND

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Envirommental assessment Upper Mississippi River

A. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The objectives of the study are to investigate alternatives for development of area water and related land resources, to solve flooding problems, and to investigate solutions to drainage, erosion and sedimentation, and water quality problems. The overall basin study will be in three stages: Development of a plan of study to identify resource management problems; (2) Assessment of water and related land resource problems and needs, and (2) Analysis of alter-

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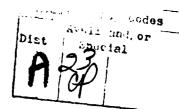
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Problems of funding, manpower, and schedule requirements caused by the large scope and complexity of the study are evaluated in the following discussions of alternative schedules shown on pages 176 through 178. The 5½-year schedule on page 176 is an attempt to comply with current regulations on study length for both the SCS and Corps. This time constraint makes the resulting annual funding and manpower requirements in excess of the capability for both agencies. The schedule on page 177 adjusts the overall length of schedule to comply with fiscal year 1979 agency budget limitations (assumes Corps is funded \$400,000 based on House and Senate conference report and SCS is funded \$694,000). Although this schedule would only extend the study approximately 6 months, the resulting annual funding and manpower requirements for other fiscal years are in excess of both agencies' capabilities including contracting.

The schedule on page 178 (also see attached table) is based on the projected maximum manpower available at the two agencies. This schedule projects an 8-year study period and provides for an alternatives report at the end of the first year of study. The alternatives report will display the first iteration of alternative components based on gross appraisals of readily available data. A preliminary feasibility (Stage II) report will present results of the second iteration of alternative land and water resource management plans midway in the study. Draft and final feasibility reports will display a final iteration of alternative plans including NED, EQ, and the selected plan of improvement at the end of the 8-year study. The above study approach accomplishes investigations for the entire study area.

A different study approach, recognizing limitations of funding and manpower, could maintain continuity of hydrologic and economic investigations on the overall study area while conducting interim studies on the





3

five individual river subbasins as interrelationships are resolved (see attached table). These interim studies could be started about 1 year apart and each completed within 2 to 3 years, followed by a final 2-year report at the end of the 10-year study.

Some of the advantages and disadvantages apparent from comparison of the total 8-year study approach and the interim study approach are tabulated below.

# Total Study Approach

# Advantages

 Optimum construction scheduling for distribution of benefits

### Interim Study Approach

### Advantages

- 1. Timely submission of study results, authorization, preconstruction planning, and construction.
- 2. Benefit of damages prevented in frequent flooding areas actually realized sooner.
- Local interests favor shorter study and earlier construction.
- Construction of feature No. 1 could begin 10 years earlier.
- Review of hydrologic-economic base for scale of development is repeated.
- 6. Public involvement and study management would be more readily conducted.
- 7. Better use of planning staffs, uniform annual budget, and more uniform sequencing of construction.

# Disadvantages

- First report on feasibility of potential project in 8 years.
- Any changes in scale of development caused by changes in hydrology and economics within the 8-year study would cause change and delay in project.
- Local interests do not favor longer studies before first construction.

## Disadvantages

1. Study and construction sequence could use majority of monetary benefits for first in-place construction leaving limited amount for downstream improvements.

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# APPENDIXES

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APPENDIX B: LETTERS OF ASSURANCE AND COORDINATION

# UPPER MINNESOTA RIVER SUBBASINS STUDY (PUBLIC LAW 87-639)

# RECONNAISSANCE STAGE REPORT (PLAN OF STUDY)

#### INTRODUCTION

In June 1972, the Upper Mississippi River Basin Coordinating Committee submitted the completed Upper Mississippi River Comprehensive Basin Study to the Water Resources Council. The study presented a framework program for development and management of water and related land resources in the Upper Mississippi River basin.

Included in the report was a summary of concerns recommended for further study. In the Minnesota River basin, these concerns included water quality, flood and sediment damage, water supply, commercial navigation, recreation opportunity, and environmental preservation. The proposal suggested that a regional or river basin plan, based on guidelines established by the Water Resources Council, be coordinated by a river basin commission responsible for focusing on middle-term (next 10 to 15 years) needs and desires.

The Southern Minnesota Rivers Basin Board was created by the Minnesota Statutes, Chapter 705, Laws of 1971, to coordinate resource planning in the basin. The U.S. Department of Agriculture participated in a Type IV river basin study under the authority of section 6 of Public Law 83-566 authorizing the Secretary of Agriculture, in cooperation with other Federal, State, and local agencies to make investigations and surveys of the watersheds of rivers and other waterways as a basis for development of coordinated programs. The study was completed by the Southern Minnesota Rivers Basin Board in February 1977.

The Secretary of Agriculture designated the Soil Conservation Service to provide leadership in carrying out the department's responsibilities in conducting the study. The Forest Service and the Economic Research Service participated under provisions of a Memorandum of Understanding dated 15 April 1968 (RB-2, Rev., dated 6 May 1968). The Southern Minnesota Rivers Basin Board recommended that a joint study by the Department of the Army and the Department of Agriculture, authorized by Congress under Public Law 87-639, be used to aid in solving the problems in study area II of the overall Type IV river basin study.

#### **AUTHORITY**

The Governor of Minnesota asked Congress to authorize the Corps of Engineers and the Soil Conservation Service under Public Law 87-639 to conduct an implementation study for the area. The following resolution authorizing the study was passed by Congress in December 1975.

"Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Secretary of the Army and the Secretary of Agriculture are hereby authorized and directed to make joint investigations and surveys, as provided by Public Law 87-639, of the Redwood, Cottonwood, Yellow Medicine, Lac Qui Parle, and Yellow Bank Rivers' sub-basins of the Minnesota River Basin and to prepare joint reports on such investigations and surveys setting forth their recommendations for the installation of works of improvement needed for flood prevention or the conservation, development, utilization and disposal of water, and for flood control and allied purposes. Such joint reports shall be prepared and submitted in compliance with the provisions of the public law cited herein."

### STUDY OBJECTIVES

The objectives of this study are to:

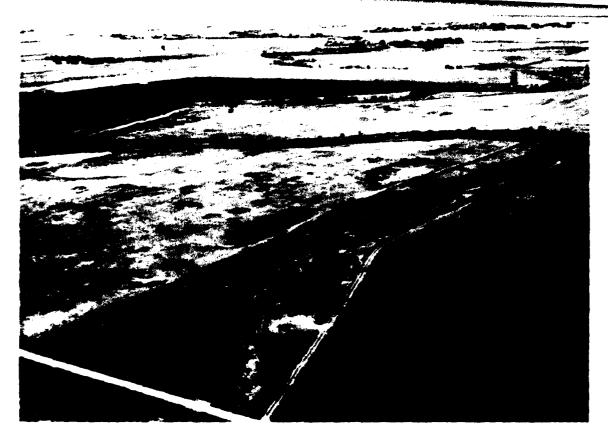
 Further investigate and clarify alternatives for orderly development of water and related land resources of the study area.

- Solve the flooding problems including crossover flooding between adjoining watersheds.
- Investigate solutions to drainage, erosion and sedimentation, and water quality problems.

The study will consider beneficial and adverse impacts of alternatives to improve recreation, fish and wildlife resources, and other environmental features peculiar to the basin. The following photographs are views of the Yellow Medicine and Mud Creek subbasins, respectively.



Typical floodplain along the Yellow Medicine River, April 1976



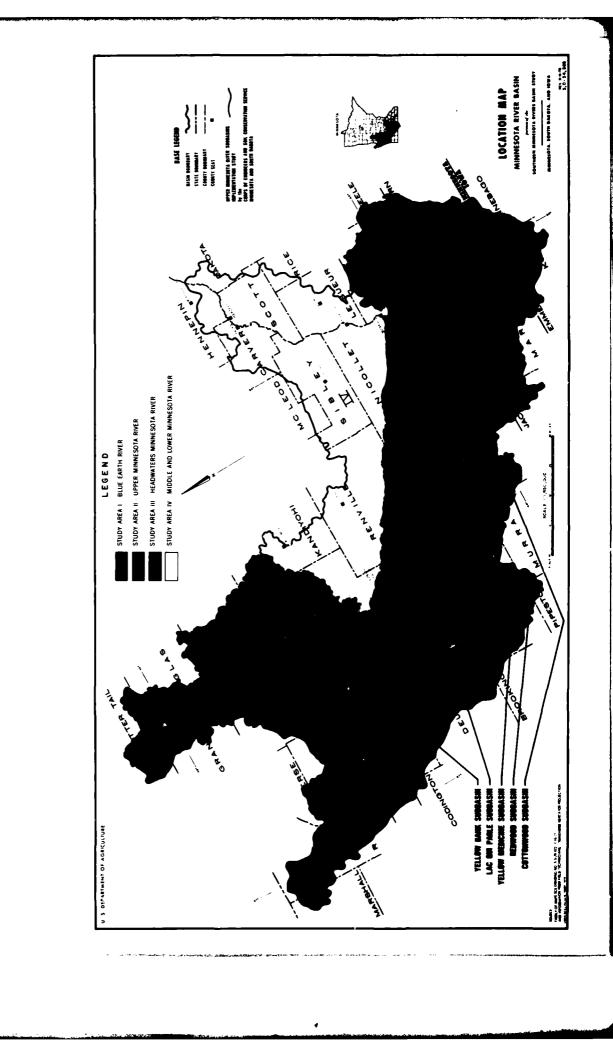
Mud Creek subbasin, looking southwest toward the distant Coteau des Prairies, June 1972

# RESOURCES AND ECONOMY

# LOCATION

The Minnesota River basin is part of the Upper Mississippi Water Resources Region. The Little Minnesota River (headwaters of the Minnesota River) drains the eastern slope of the Dakota foothills in South Dakota, approximately 30 miles west of the Minnesota border, and flows southeast to Big Stone Lake. From Big Stone Lake the Minnesota River flows southeast to Mankato, Minnesota, where it turns and flows northeast to its confluence with the Mississippi River in St. Paul-Minneapolis, Minnesota.

The Minnesota River basin, 16,770 square miles (10,732,000 acres), includes all or parts of 37 counties in Minnesota, 6 in South Dakota, and 3 in Iowa. The authorized study area comprises 4,183.8 square miles (2,677,632 acres) which is 33 percent of the Minnesota River basin and includes all or part of nine counties in Minnesota and four counties in South Dakota. The following figure shows the location of the study area. The study area, divided according to State and county, is described in the table on page 7.



State	County	County area (square miles)	Study area (square miles)	Percent of county in study area
Minnesota	Brown	618	269.7	44
	Cottonwood	645	249.6	39
	Lac qui Parle	775	570.8	74
	Lincoln	541	457.1	84
	Lyon	716	688.8	96
	Murray	721	110.8	15
	Pipestone	464	25.7	6
	Redwood	874	670.0	77
	Yellow Medicine	758	453.3	60
Total			3,495.8	
South Dakota	Brookings	809	23.8	3
	Codington	766	23.0	3
	Deuel	644	334.0	52
	Grant	687	307.2	45
Total			688.0	
Total study ar	·ea		4,183.8	

SOURCE: 1967 Conservation Needs Inventory, Soil Conservation Service, U.S. Department of Agriculture.

#### CLIMATE

The study area has a continental climate and is subject to frequent influxes of continental polar air throughout the year. Cold waves are usually of the boreal type - rushing south over the area from the continental arctic regions. Occasional periods of high temperature occur in the summer when warm air pushes north from the Gulf of Mexico and the southwestern United States. When Pacific Ocean air masses move across the western United States, they produce comparatively mild, dry weather in all seasons.

Mean annual temperatures range from 42° F to 45° F from west to east. The July mean temperature is 74° F; the January mean temperature is 13° F. The freeze-free (air temperature greater than 32° F) growing season generally starts about the second week of May and ends during the first week of October. The eastern area in Brown County has the longest growing season – approximately 140 days. The northernmost part of the area in South Dakota has approximately 120 freeze-free days. The soil freezes about the first week of December and thaws about mid-April. Average maximum freeze depth in the area is from 3 to 4 feet, exclusive of forested regions where the freezing depth is usually shallower.

Mean annual precipitation ranges from 28 inches in Brown County, Minnesota, to 22 inches in the South Dakota portion of the study area. Normal rainfall during the crop season ranges from 18 inches in the eastern part of the study area to 14 inches in South Dakota. Approximately two-thirds of the annual precipitation occurs during the crop season.

Seasonal snowfall averages 40 inches in the study area near the border and accounts for 30 percent of total precipitation. Snow cover of 1 inch or more over the basin averages 90 days annually.

Moderate or worse drought conditions are expected at least once in 4 years except in the western watersheds where they occur about once in 3 years. Severe or extreme drought conditions occur on the average of once in 8 years, except in the southwest where they occur about once in 6 years. Generally, the more severe droughts persist or recur several years in succession.

Average annual lake evaporation is 35 inches. Annual pan evaporation ranges from 40 to 48 inches a year. The actual daily evapotranspiration (evaporation from land and plant surfaces) averages about 0.15 inch daily during June, July, and August. Row crops average approximately 20 inches of evapotranspiration a year. However, the average annual potential evapotranspiration, assuming adequate soil moisture at all times, is nearly 24 inches.

Thunderstorm winds are a frequent cause of damage to property and crops throughout the area. The annual frequency during the growing season is about once in 45 days. Eighty percent or more of these storms occur during the heavier rainfall months - May through September. Tornadoes occur most frequently between May and July; they are most prevalent in June. Damaging local windstorms, tornadoes, hail, and heavy rains occur with the stronger and more well-developed thunderstorms.

### GEOLOGY AND PHYSIOGRAPHY

The study area is within the "western lake section" central lowland province of the interior plains physical division of the United States. This section is characterized by young glaciated plains, moraines, lakes, and lacustrine plains.

The surface materials and features are a product of recent glaciation. Glacial materials cover most of the sediment and ancient bedrock in the study area but ancient bedrock and younger sedimentary rock are exposed in a few places. The bedrock is among the oldest rock known on earth, dating back over 3 billion years.

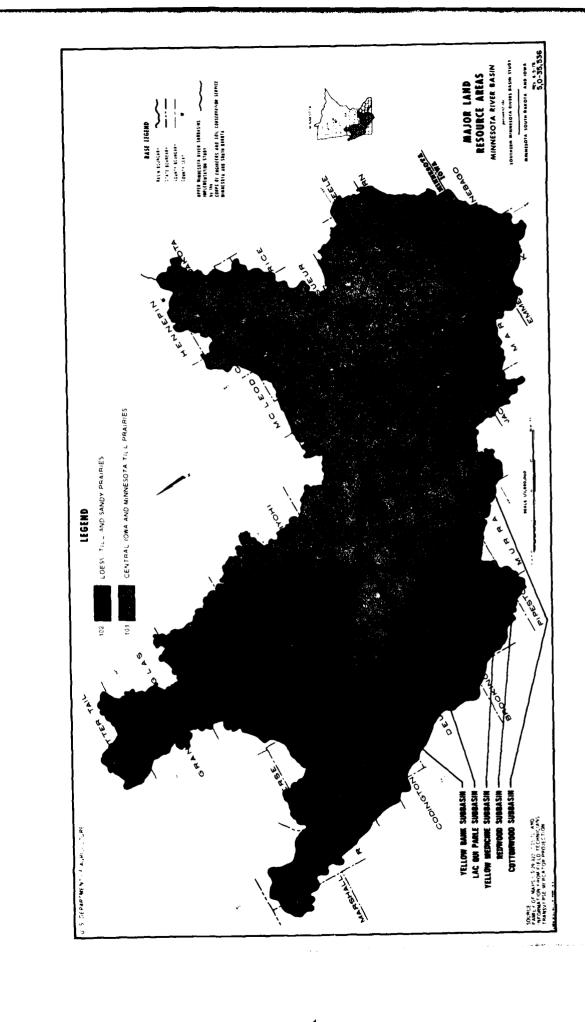
The topography over the northeast two-thirds of the study area is flat to gently undulating. Subdued hills and ridges border the outer limits on the south and southwest. Watershed divides over much of the area are indistinct. The Coteau des Prairies sloping escarpment rises about 2,000 feet along the southwest side of the study area with the highest elevation in Grant County, South Dakota. The outlet of the Minnesota River at the study area boundary has an elevation of 775 feet, which accounts for 1,225 feet of total relief.

The natural drainage pattern was established by the rivers and valleys formed by glacial meltwaters. The present low gradient streams occupy these older systems practically without modification. The present drainage network is poorly defined except for the major rivers. Considerable areas have no outlet. Interior watershed divides are indistinct and crossover flooding is a common occurrence. Channel construction over the last half centry has established a man-made drainage network over the area. Large areas do not have major channels with adequate capacity.

### LAND RESOURCE AREAS

The Minnesota River basin is within the Central Feed Grains and Livestock Region. This land resource region is further broken down into land resource areas (LRA) - broad geographic areas having similar soil, climatic, geologic, vegetative, and topographic features. (1) The basin is located within portions of two major land resource areas: 102 - Loess, Till and Sandy Prairies; and 103 - Central Iowa and Minnesota Till Prairies. The land resource areas are shown on the following figure and described on page 12.

<sup>(1)</sup> Minnesota River Basin Report, Chapter II, Section D, page II-4.



The majority of the western half of the basin is in LRA 102 (Loess, Till, and Sandy Prairies). Chernozem soils developed on calcareous loam till are dominant. Topography is mostly undulating, but ranges from nearly level to hilly. Typical soils are Barnes and Langhei in the uplands, Flom and Parnell in the lowlands, and Arvilla and Maddock in the outwash. Nearly all land is cultivated, mostly with row crops and small grains. Water and wind erosion are serious problems and drainage is a problem on wet cropland soils.

The central and eastern portions of the basin are in LRA 103 (Central Iowa and Minnesota Till Prairies). The central portion consists of Brunizem and Humic Gley soils developed on calcareous loam and clay loam till. Topography ranges from nearly level to hilly, but is mostly gently undulating. Nearly all of the area is under cultivation with row crops being the most common crops. The eastern edge of the basin consists of gray-brown Podzolic or gray-brown Podzolic-Brunizem intergrade soils developed from calcareous loam and clay loam till. Topography in this area ranges from undulating to steep. Nearly all of the land is cultivated, mostly with row crops, hay, and small grains. Erosion is the most serious problem on rolling cropland. Lack of drainage associated with poorly drained cropland soils is also a problem. Typical soils are Clarion, Lester, and Hayden in the uplands; Webster, Dundas, and Glencoe in the lowlands; and Estherville, Hubbard, and Burnsville in the outwash.

# LAND USE DISTRIBUTION

Land use varies within the study area. The total 2,677,632 acres represents 25 percent of the total 10.7 million acres in the Minnesota River basin. The 1974 agricultural land use pattern is shown in the following table.

Study area land use, 1974 (1)

Use	dy area land use, 1974	Percent
Cropland	Acres	80
Corn (2)	2,142,120	
Corn	(835,426)	(39)
Soybeans	(556,951)	(26)
Oats	(214,212)	(10)
Pasture in rotation	(171,370)	(8)
Alfalfa hay	(128,527)	(6)
Small grains (3)	(107,106)	(5)
Idle (4)	(64,264)	(3)
Other	(64,264)	(3)
Pastureland	240,980	9
Forest land	53,550	2
Other land	133,882	5
Noninventory	107,100	4
Total	2,677,632	100

<sup>(1)</sup> Adjusted 1967 Conservation Needs Inventory data, Soil Conservation Service.

<sup>(2)</sup> Corn includes corn for both grain and silage. Approximately 90 percent of corn grown is harvested as grain and 10 percent is harvested as silage.

<sup>(3)</sup> Small grains are mainly spring wheat, barley, and flaxseed.

<sup>(4)</sup> Idle cropland has decreased significantly since 1967.

The largest land use is cropland. Corn and soybeans, the major crops, account for 65 percent of the cropland category. Idle cropland has decreased significantly since 1967. Higher prices for crops, coupled with the farmers' desire to make each acre economically productive, have resulted in "fence-to-fence" production. The removal of the U.S. Department of Agriculture program requirements of conserving base acres, along with expiration of many crop adjustment programs and soil bank agreements, has contributed to this shift.

Most of the forest land is located along natural watercourses; however, small acreages of forest occur on farmsteads and steep slopes. Trees remain where it is not profitable or possible to produce agricultural crops. Forests occur on 2 percent of the land area, and commercial forest accounts for 93 percent of the total forest land. Commercial forest land is forest land which does or can produce crops of industrial wood and is not withdrawn from timber use by statute or administrative regulation.

### WATER RESOURCES

Approximately 35,000 acres of surface storage is available in lakes and wetlands in the study area. Average annual runoff varies from 3 inches in the southeast to 1 inch in the northwest. The limiting season for water availability is in late fall and winter with 70 percent of floods occurring in the spring. An estimated 900 miles of streams are in the study area. The following photographs show typical lake and river scenes. Data on study area lakes and rivers are given in the tables on pages 16 and 17.



Typical lake scene in study area, July 1972



Yellow Medicine River, Normania Township, Yellow Medicine County, 1976

Lake improvement investigations, general information

		Pub.	Division								2	Max1-			Littoral	Wildlife		
		25	Jo	;			Meandered			_	Wet- m					manage-		
County	Lake name	I.D. Number	waters (acres)	Planimetered area and year	tered d year	Type outlet	water body?	Section	Location on Twp Range		land depth type (feet	_	Management 1sh Marg.	Game	(Fish lake only)	ment	Public access	Remarks
Minnesota Brown	Boys Sleepy Eye	8-96	160 290	362.4	- 1947 - 1947	Creek Ditch	Yes	11-14 19,20 29,30	109		VA V	9/	× , <b>x</b>		100 percent 2.4 mi.			Dam at outlet
Cortonwood	Bean Double	17-54 17-56	141 227	189.77 245.92	- 1948 - 1948	Overflow Creek	Yes	14 22,23 26	107	38	VA VA		××		shore		Yes. county Yes.	countyGLS-1948
	Long	17-48	262	260	- 1948	Stream	Yes	22,23	30£	38	ΙΛ	5		×			Yes, county	GLS-1948
Lac qui Parle	Lac qui Parle	37-46	4,625/ 8,400	5,589		Minnesota Yes River	a Yes		118- 120	42- 43	>	14	×		100 percent		Yes (5)	Yes(5) Also in Chippewa Swift Lake Survey
	Pegg Salt (Rosabel)	37-224 37-229	133 259 (312)	09	- 1964	CD 2 None	No	5,8	118	97	11 0	4.0		× ×				Also in South Dakota GLS 1964
Lincoln	Benton	41-43	2,875	2,857.1	- 1956	Creek	ves		104,	444	VA	6	×		100 percent	T.	Yes (2)	Yes(2) FLS-1956
	Hendricks	41-110	684 (1,634)	8.699		Creek	Yes	18,19 23,24	112	_	>	10	×				Yes	950 acres in South
	Shoakatan	41-89	1,043	995 LS map	1.957		Yes	22,24 26-28	111	97	>	12	×		100 percent	, L		Resort SE end
Lyon	Cottonwood 42-14	42-14	383	376	- 1967	Ditch	Yes	2,4	113	7 07	۸A	œ	×				Yes,	GLS-1967
	Goose	42-93	151	154	- Blue book		Yes	29,32 33	111	43	۸A		×				Yes, State	
	School	42-2	348				Yes	35,36	113	39-	٧A	11	×				Yes,	
	West Twin	42-74	237				Yes	29-32	109		۸A	10	×				Yes, county	GLS-1948
Yellow Medicine	Miedd	87-61	148	171	- 1967	Channel	No.	23,26	114	41	ΛI	S		×				GLS-1967
	Spellman Spellman	87-60)	300	162 110	- 1967 - 1967	Ditch Channel	Yes	16,22,23	114	41	1V VA 7	5 7.5	×	*				GLS-1967 GLS-1967
South Dakota																		
Brookings	Hendricks Oak	4											×					
Deuel	Cochrane	(¥)											×					

GLS - Came Lake Survey (DNR) FLS - Fish Lake Survey

É

				U.S. Geological	Survey water	quality data	Currently taking specific conductance, temperature, and sediment readings						Water quality monitor- ing discontinued
					Low flow (cfs)	/-day 10-year	0.1	0.1		0.4	0.1	0.3	2.5
Data on Study area rivers	Flow duration	Percent of time	discharge	equal to		greater	91.3 48.2	86.6 52.3	81.3 53.2	91.0 52.9	91.9 55.8	92.3 51.0	90.5 51.6
	Flow d			Dis-	charge	(crs)	1.0	0.20	0.10	2.20 12.0	1.30	1.50	10.0
			Runoff	(inches		year)	1.94	1.64	2.48	2.12	1.99	1.92	2.83
Dat				_		Average	56.9	119	20.3	102	45.1	98.8	267
							0	0	0	0	0	0	0.5
					F10	Maximum Minimum	6,970	17,100	4,430	17,200	5,590	19,700	28,700
	}   		Drainage	area	(square	miles)	398	983	111	653	307	269	1,280
			<b>A</b>			River basin	Yellow Bank River near Odessa, Minnesota	Lac qui Parle River near Lac qui Parle, Minnesota	South Branch Yellow Medicine River at Minneota, Minnesota	Yellow Medicine River near Granite Falls, Minnesota	Redwood River at Marshall, Minnesota	Redwood River near Redwood Falls, Minnesota	Cottonwood River near New Ulm, Minnesota

Groundwater is available from glacial sand and gravel aquifers and sedimentary bedrock aquifers. More than half of the study area supplies are from cretaceous bedrock aquifers which provide nondependable, low yielding, poor quality water supplies.

# WATER QUALITY

The water from the glacial deposits is very hard, contains high iron concentration, and requires treatment for public water supply. Water samples from the northwestern portion of the area range in hardness from 400 mg/l (milligrams per liter) to more than 1,000 mg/l. Dissolved solids as high as 2,000 mg/l are found, with iron as high as 10 mg/l. In many areas, the iron content of wells is 10 times the 0.3-mg/l maximum content recommended for drinking water.

The Office of Water Data Coordination, U.S. Department of the Interior, lists 11 U.S. Geological Survey surface water data collecting gaging stations and 1 water quality collection location in the study area. Hydrologic atlases covering the study area have been published by the U.S. Geological Survey in cooperation with the Minnesota Department of Natural Resources, Division of Waters. Data on quantitative yields, natural quality, use suitability, quantitative withdrawals, and consumption from ground and surface sources are contained in the atlases. For the study area, all the rivers, except the Cottonwood River, have had periods of no flow and periods of relatively poor water quality.

The Minnesota Pollution Control Agency has published a Minnesota River basin plan which divides the basin into segments and classifies the segments as to water quality. Approximately one-half of the basin is classed as "effluent limited" and the other half as "water quality limited." The water quality limited area, unlike the effluent

limited areas, will probably not meet relevant water quality standards, even after application of the best feasible technology for industries and secondary treatment facilities for municipalities as defined in the 1972 Federal Water Pollution Control Act Amendments. More advanced treatment for municipalities and industries, as well as non-point source pollution control, appears necessary.

#### FISH, WATERFOWL, AND WILDLIFE

Originally, most of the study area was a vast expanse of midgrass and tallgrass prairie with extensive lake and wetland acres. Woodlands occurred along the rivers and streams and surrounded many of the lakes and wetlands. The predominant wildlife species included buffalo, antelope, elk, deer, beaver, otter, mink, muskrats, various species of waterfowl and shorebirds, grouse, prairie chicken, squirrels, and rabbits.

The conversion of prairie and wetlands to agricultural uses has produced habitat conditions unlike those observed by early settlers. Nearly 90 percent of the land is now cropland or pastureland. Native prairie occurs only as small, isolated remnant patches. Forested acres along the rivers and tributaries, combined with woodlots, farmsteads, and field windbreaks, total 53,550 acres, or 2 percent of the total land area. Less than 40,000 acres of wetlands remain. This shift in land use has eliminated buffalo and elk from the area and replaced them with species more adaptable to farmland habitat. A small remnant herd of antelope exists in the South Dakota portion of the area.

The introduced ring-necked pheasant and 'lungarian partridge and the native squirrels, rabbits, waterfowl, furbearers, and white-tailed deer are the dominant animal species. Upland game bird and mammal populations have steadily declined since their peaks in the middle 1950's. The number

of cottontails and jack rabbits has decreased. Intensified agriculture has shifted from crop rotation, which included small grain and hay, to continuous row cropping on more acres each year. Harvest efficiency has increased, leaving little waste for winter food. Considerable natural cover has been converted in the process.

August roadside pheasant censuses (1948-1974) show high populations of ring-necked pheasants between 1955 and 1958 and steadily declining numbers since 1962 (see the figure on page 64). Because of the shortage of winter food and cover and inadequate distribution of nesting habitat, the pheasant breeding population is only about 15 percent of previous levels.

The Hungarian partridge was never as abundant as the pheasant. The downward trend of this species appears to have been halted and counts have increased in recent years.

The mourning dove, a migratory upland bird, inhabits the study area when food is abundant and conditions are ideal. Its numbers have increased and the species appears to be doing well. Doves are protected from hunting, but show good potential to supply hunting opportunities.

White-tailed deer habitat is primarily restricted to the wooded river bottoms and lands associated with them. Farmlands provide abundant food; thus, winter starvation losses are minimal. The quantity and distribution of forest and brush cover are the limiting factors. The highest deer concentrations occur where croplands are marginal and dissected by windbreaks, woodlots, or forest and brush areas. Very high local densities are attained with this fringe effect. However, most of the forests in the study area are mature stands and moderately heavily grazed, leaving little or no undergrowth and ground vegetation. This produces only fair quality habitat. White-tailed deer and duck harvest data are shown in the following table.

Deer and duck harvest per square mile, upper Minnesota River subbasins (1)

eer and duck harvest pe	Number harvested per	square mile
Year	Deer	Duck
1967	0.4	10.92
1968	0.27	72
1969	0.24	11.52
1970	0.40	1~ 7
1971	(Season closed s	tat <b>e</b> wide)
1972	0.31	
1973	0.44	
1974	0.25	

<sup>(1)</sup> From the Minnesota Department of Natural Resources Project Quarterlys.

Habitat quantity and quality are the major factors which control populations. When either declines, disease, starvation, predation, and winter take larger numbers of individuals, successful reproduction decreases, and total populations drop. Adequate food and cover are especially critical during winter and reproduction and rearing periods.

Excellent habitat is provided on approximately 31,600 upland acres which are included within State and Federal management areas, generally in association with wetlands. Windbreaks, roadside ditches, and scattered natural areas provide the ramining upland habitat.

The study area contains a number of wetlands. Along with wetlands in surrounding States and Canada, they comprise the major waterfowl production area for the entire midsection of the United States. The most common game species of waterfowl include mallard, blue— and green—winged teal, ring—necked duck, wood duck, Canada goose, and snow goose. Numerous other species of waterfowl and shorebirds are

found throughout the study area. Wetland and associated nesting and brooding habitat is but a fraction of former acreages. Dry and drained basins total nearly 30,000 acres. Croplands have long provided adequate food supplies. The major impact from agriculture has been wetland drainage. Major efforts to preserve and enhance the remaining wetlands are needed. Duck harvests have gradually increased primarily because of increased hunting days per season per hunter.

Some species have not been able to adjust to the environmental change. Rare or endangered species that may be seen in the study area include the bald eagle, golden eagle, greater sandhill crane, pileated woodpecker, American osprey, American peregrine falcon, arctic peregrine falcon, and whooping crane. The status of these and other species is periodically reviewed and updated by State wildlife agencies and the U.S. Fish and Wildlife Service.

Fish lakes total 20,938 acres in the study area. The following table illustrates the numbers of these lakes.

Fish lakes and marginal fish	lakes (10 acres or larger) (1)		
Item	Amount		
Fish lakes			
Number	7		
Acres	7,109		
Marginal fish lakes			
Number	42		
Acres	13,829		
Total			
Number	49		
Acres	20,938		
Number Acres Marginal fish lakes Number Acres  Total Number	7,109 42 13,829		

<sup>(1)</sup> Minnesota Department of Natural Resources Lake Inventory Classifications.

Many of these lakes are shallow, fertile, and classified as rough fish lakes. Lake game fish include northern pike, largemouth bass, walleye, crappie, and sunfish. Of the total annual catch by weight, about 30 percent are northern pike and about 20 percent are crappie and sunfish. Bullheads are well suited for winter survival in shallow waters. Although considered a rough fish in many areas, bullheads account for about 25 percent of the total harvest by weight each year.

Rivers and streams provide 900 miles of riverine habitat throughout the study area. Most of the rivers and streams provide marginal warmwater habitat and sustain mostly rough fish populations. Brook and brown trout occur in the few remaining cold water reaches. Smallmouth bass, rock bass, and crappies inhabit the better warm water reaches.

Carp and other rough fish have invaded most of the streams and many of the lakes. Quality of fish habitat has decreased with increased erosion and siltation and accelerated eutrophication of water bodies by nutrient rich runoff from agricultural lands. Urban and industrial pollution is also a growing contributor to the degradation.

## RECREATION RESOURCES

Outdoor recreation opportunities are many and varied. A summary of recreation activities is presented in the following table.

Estimated activity occasions occurring				
Activity	Number of occasions			
Swimming	39,598			
Golf	4,401			
Tennis	2,898			
Outdoor games	68,169			
Walking for pleasure	11,301			
Bicycling	50,198			
Horseback riding	3,660			
Trap and target shooting	1,113			
Fishing	9,741			
Boating	3,552			
Canoeing	1,973			
Water-skiing	9,204			
Sailing	574			
Camping	7,887			
Hiking	845			
Picnicking	13,633			
Nature walks	16,577			
Snowmobiling	14,506			
Snow skiing	675			
Small-game hunting	5,232			
Large-game hunting	10,273			
Waterfowl hunting	3,495			

Data on recreation facilities are provided in the Minnesota Department of Natural Resources 1974 SCORP (State Comprehensive Outdoor Recreation Plan) and the recently completed inventory of private facilities by the National Association of Conservation Districts. Most facilities are not adequate to meet the present demand when acceptable space standards are applied. The following photograph shows a public picnic area.



## CULTURAL, ARCHEOLOGICAL AND HISTORICAL RESOURCES

In a historical sense, the heart of Minnesota lies in the river valley which gave the State its name. Since glacial times, this valley has witnessed man's struggle to survive and control his surroundings. About 10,000 years ago, primitive hunters camped on the edge of melting sheets of ice in pursuit of the mammoth and giant bison. Brown's Valley Man left his bones and weapons to be found by later inhabitants. Over a period of thousands of years, more sophisticated cultures gradually developed in this central river valley. The ancestors of the modern Indian built permanent villages, raised crops, hunted, fought and built mounds for their dead along its bluffs. The dawn of recorded history found the Dakota or Sioux Indians well established on the borders of the river.

Among the more significant prehistoric sites in or near the study area are:

- Brown's Valley Man (6000-5000 B.C.), Browns Valley, Traverse County, Minnesota.
- Pederson Site (c. 1000 B.C.-1600 A.D.), Lake Benton, Lincoln County, Minnesota.
- Pipestone National Monument (prehistoric to present), Pipestone County, Minnesota.
- Fox Lake (500 A.D.), near Sherburn, Martin County, Minnesota.
- Mountain Lake (c. 1000 B.C.-1600 A.D.), Cottonwood County,
   Minnesota.
- Jeffers Petroglyphs (3000 B.C.-1700 A.D.), Cottonwood County,
   Minnesota.
- Cambria (1200 A.D.), Blue Earth County, Minnesota.

Concentrations of prehistoric sites are in the Big Stone Lake area, in the Blue Earth River drainage, and along the lower Minnesota River from Henderson downstream to the river's mouth. Many of the prehistoric sites are on the National Register of Historic Places. In addition, the following Historic Districts are listed in the National Register:

- Lac qui Parle Mission and Village Historic District, Chippewa and Lac qui Parle Counties, Minnesota.
- Upper Sioux Agency Historic District, Yellow Medicine County,
   Minnesota.
- Lower Sioux Agency Historic District, Redwood County, Minnesota.
- Lake Benton Historic District, Chippewa County.

Written records of the Minnesota River basin extend back to 1700 A.D. when Pierre Le Sueur, a French trader and explorer, built a fort called L'Hillier on the Blue Earth River near modern Mankato. Jonathan Carver, a New Englander, wintered on the St. Peter's (Minnesota) River near modern Carver, Minnesota, in 1767. During the American Revolution, Peter Pond, a Yankee trader, canoed up this river to trade with the Sioux tribe. In 1805, Lieutenant Zebulon Pike bought the land at the junction of the St. Peter's and Mississippi Rivers as a site for a military post. In 1820, United States troops began to build a stone fort on the bluff overlooking these rivers.

For the next 30 years, the St. Peter's River valley remained the home of many bands of Sioux Indians, fur traders, and their descendants. Fort Renville, a fur post, was operated at the widening of the river called Lac qui Parle from about 1826 to 1845. Nearby was built the Lac qui Parle Mission which sought to educate and christianize the Sioux. Later, missions were built downstream at Hazelwood and Traverse des Sioux, Minnesota. From 1847 to 1862, hundreds of wooden Red River carts laden

with buffalo hides from Pembina, North Dakota, on the Canadian border put deep ruts in the river bottoms and made the Red River Trail which terminated at St. Paul.

The treaties of Traverse des Sioux and Mendota were signed in 1851. By their terms, the resident Sioux Indians ceded millions of acres of rich land between the Mississippi and Big Sioux Rivers to the white man. These documents restricted the Indians to a narrow reservation on the upper Minnesota River and opened the ceded land to white settlers. Fort Ridgely was later built on the river near Fairfax in Nicollet County, Minnesota; the Lower and Upper Sioux Agencies were built near Morton and Granite Falls, Minnesota. At these locations, efforts were made to teach the ways of the white men to the Indians. Nearby was erected the elaborate stone "castle" of Joseph R. Brown, a noted frontiersman and public figure.

By 1872, over 2,000 miles of railroads had been laid in Minnesota, allowing development of communities on the rich prairie lands. With the railroads, communities were no longer limited to locate along navigable streams. The developing transportation and communication network spread the word of fertile soils in the Minnesota River valley quickly and brought many immigrant families to the area. By 1870, the population in the Minnesota River basin had grown to over 85,000 persons. At the turn of the century, the population exceeded a quarter of a million persons. This flood of immigration abruptly changed the economic structure of the area from subsistence agriculture, lumbering, and remnants of the fur industry to a commercial agricultural economy with exports of wheat, oats, corn, barley, and potatoes.

With the close of the Sioux and Civil Wars, settlers changed the valley into farmland. Railroads replaced steamboats as the mode of transportation and the frontier was supplanted by farms, villages, and towns.

Archeological and historical sites in the study area are shown in the following table.

Archeological and historical sites in Item	the study area	
	Mullet	
Archeological sites		
Mounds and burial sites	56	
Habitations and villages	28	
Other (1)		
Total	90	
Historical sites		
Forts and missions	22	
Historic houses	6	
Indian conflicts	3	
Other <sup>(2)</sup>	<u>27</u>	
Total	58	
Total sites	148	

<sup>(1)</sup> Includes sites of bison kills, petroglyphs, rock alignments, dance rings, and undetermined status.

## UNIQUE AND SCENIC AREAS

Certain areas and sites in the study area exhibit unique characteristics and, whether natural or historic, provide residents and visitors with a special kind of aesthetic experience or insight into the region's past. In the basin, 51 unique natural and scenic sites have been inventoried (see the following table).

<sup>(2)</sup> Includes sites of geology markers, historic trails, ethnic settlements, folklore markers, historical districts, and architectural sites not included in the historic houses category.

Unique natural and scenic areas in	n the study area (1)
Area	Number
Waterfall	2
Rapids/whitewater	2
Beach	2
Land form	5
Prairie remnant	4
Scenic timber	2
Rare flora	2
Natural and scientific area	4
Fish habitat	5
Game habitat	14
Viewpoint or vista	4
Historic significance	_5
Total	51

<sup>(1)</sup> From Minnesota Department of Natural Resources document, "Natural and Historic Areas of Minnesota," 1971.

# **IRRIGATION**

At present, irrigation is not a significant practice in the study area. Approximately 1,270 acres is being irrigated. Another 8,000 acres has potential for irrigation.

# AIR QUALITY

Generally, air quality in the study area is good. Some localized wind erosion could be a problem where airborne soil acts as an irritant. This occurs where topsoils are sandy or very light textured, especially during drought years when plant cover is inadequate. Land treatment practices are important in controlling wind erosion.

#### HUMAN RESOURCES

The study area's population characteristics and trends are similar to most of rural America. Over the past two decades, the total population has remained stable with decreases in the rural population offset by increases in the larger urban centers. Greater economic opportunity has motivated younger persons to move from farms and small towns to larger towns and cities. This migration has left a slightly older population in many rural areas.

The population decreased from 131,000 in 1950 to 122,000 in 1970. Of this total, the urban population increased from 33,000 to 43,000, the rural nonfarm population decreased from 38,000 to 36,000, and the rural farm population decreased from 60,000 to 43,000. The education level of persons 25 years of age and older is slightly lower than the State average of 47 percent completing high school and 12 percent completing college.

Family and per capita incomes in the study area lag behind the State averages of \$11,098 and \$3,052, respectively. The 1970 family mean income, \$8,693, and per capita income, \$2,414, are 21 percent lower than the State averages. Approximately the same proportion of families in the study area is classified as middle income (\$5,000 to \$15,000) as compared to the State average; but a higher proportion falls into the low income groups, and a lower proportion is in the high income groups.

About 37 percent of the 1970 population was part of the study area's labor force. Unemployed workers accounted for 3.6 percent of the labor force which contributed to the outmigration from the study area. Employment by industrial classification is 24 percent agricultural, 30 percent manufacturing, 21 percent wholesale and retail trade, and 25 percent services.

#### DEVELOPMENT AND ECONOMY

Opportunities for development in the study area are determined by natural resources, environment, and existing and future economic conditions. Continued economic growth and higher levels of living are goals of resource planning. Successful resource planning requires projection of economic conditions and their accompanying resource demands. The need for resource development is then evaluated by comparing these future resource demands with available resources.

Land use in the study area is shown in the table on page 13. Development potential for the land uses is presented in chapter 3 of the Type IV study.

A well-developed transportation network connects major service-centers and provides farm-to-market routes throughout the Minnesota River basin. Although only a few miles of interstate highway have been built in the basin, other Federal and State roads provide excellent intrabasin routes and trunk lines to the Minneapolis-St. Paul, Sioux Falls, South Dakota, and Fargo, North Dakota-Moorhead, Minnesota, metropolitan areas. Current and proposed interstate routes nearly surround the basin and provide quick, easy access to areas outside the basin.

Four major rail lines operate in the basin and provide freight service to most towns. The larger towns receive daily service while smaller, more remote areas receive only weekly or triweekly service. Besides rail freight, much commerce is carried by numerous trucking companies operating within the basin.

Four intercity bus lines provide passenger service to all the larger towns and many small towns in the basin. Major airline service is provided only to Mankato and Fairmont. However, easy access is provided to the Twin Cities International Airport.

#### LAND AND WATER RESOURCES PROBLEMS AND NEEDS

#### INTRODUCTION

The problems and needs discussed below were identified during meetings, interviews, and discussions held throughout the study area with local citizens, policy committees, and technical field personnel. Problems identified, in order of importance, are:

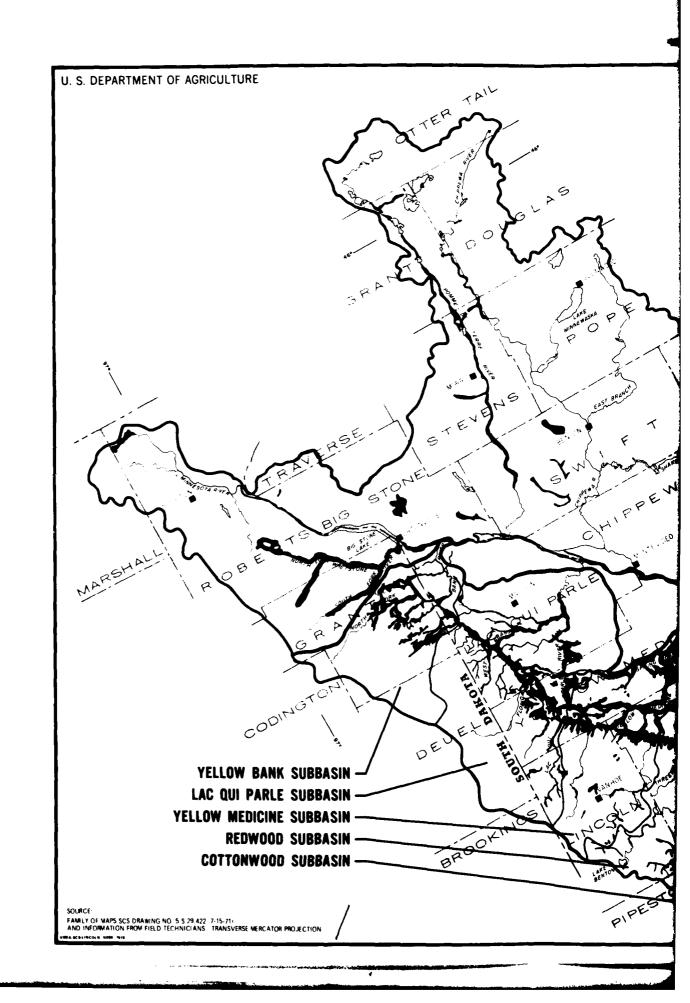
- 1. Flooding, including crossover flooding between adjoining watersheds which requires group solution.
  - 2. Inadequate cropland drainage.
  - 3. Erosion and sedimentation.
  - 4. Pollution.
  - 5. Inadequate fish and wildlife habitat.
  - 6. Lack of recreation opportunities.

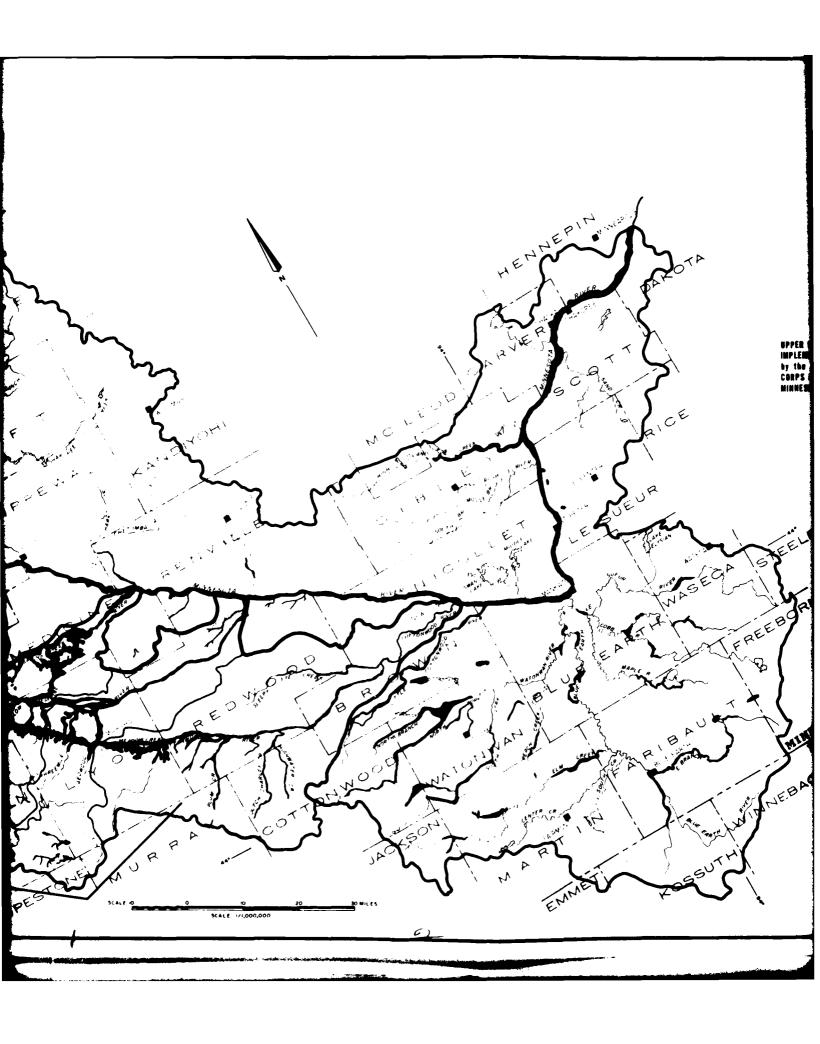
These land and water resource problems are caused by man's lack of understanding of the capabilities of the resources and his desire to use the resources for maximum economic gains.

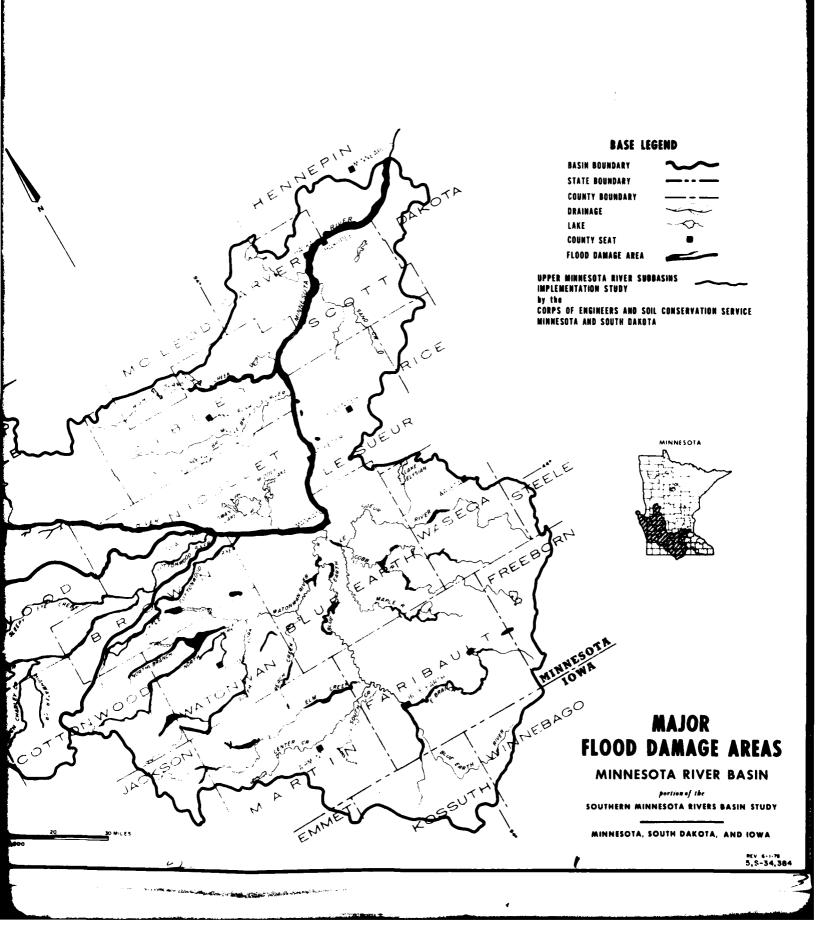
In recent years, the restoration and conservation of these land and water resources have become major concerns. Since the 1930's, damaging practices in the use of land and water have been recognized and identified. Physical capabilities of land and water were studied. Landusers have generally accepted the conservation concepts and their applications. However, even with all of the research that is involved and the energy and moneys being spent in the field of resource conservation, significant problems still remain.

## **FLOODING**

Flooding is one of the primary concerns along the Minnesota River and elsewhere in the study area. Cropland and pasture flooding occur on 302,000 acres in the study area. Flooding occurs on an additional 195,100 acres along the Minnesota River. The flooded areas are shown on the following figure.







Five principal tributaries enter the Minnesota River from the south between Big Stone Lake and New Ulm, Minnesota. These tributaries make up the following subbasins: Yellow Bank, Lac qui Parle, Yellow Medicine, Redwood, and Big Cottonwood. The following table gives the land use in the floodplain and the total area.

Floodplain land use (1)

	oupro to-					
Acres in floodplain						
Total	Cropland	Pasture	Woodland	Other		
15,300	11,300	2,900	800	300		
97,000	62,100	21,300	7,800	5,800		
96,700	69,600	14,500	3,900	8,700		
46,400	23,200	19,500	900	2,800		
46,600	30,800	6,000	5,100	4,700		
302,000	197,000	64,200	18,500	22,300		
	Total 15,300 97,000 96,700 46,400 46,600	Acres Total Cropland 15,300 11,300 97,000 62,100 96,700 69,600 46,400 23,200 46,600 30,800	Acres in flood Total Cropland Pasture  15,300 11,300 2,900  97,000 62,100 21,300  96,700 69,600 14,500  46,400 23,200 19,500  46,600 30,800 6,000	Total         Cropland         Pasture         Woodland           15,300         11,300         2,900         800           97,000         62,100         21,300         7,800           96,700         69,600         14,500         3,900           46,400         23,200         19,500         900           46,600         30,800         6,000         5,100	Acres in floodplain           Total         Cropland         Pasture         Woodland         Other           15,300         11,300         2,900         800         300           97,000         62,100         21,300         7,800         5,800           96,700         69,600         14,500         3,900         8,700           46,400         23,200         19,500         900         2,800           46,600         30,800         6,000         5,100         4,700	

<sup>(1)</sup> All figures are rounded.

Topography is flat in the lower two-thirds of the subbasins. Study results indicate the subbasins are inseparable, their problems and needs are interrelated, and a large portion of flood reduction benefits are from adjoining subbasins. Average annual damages are estimated in the following table.

Average annual flood damages

			Damages			
	Crop and	Other	Road and			
Subbasin	pasture	agricultural	bridge	Urban	Indirect	Total
Yellow Bank	\$160,900	\$18,800	\$15,700	\$300	\$20,300	\$216,000
Lac qui Parle	1,253,800	155,400	35,300	9,100	147,400	1,601,000
Yellow Medicine	1,491,300	163,400	27,800	5,700	•	1,859,000
Redwood	708,000	81,900	20,600	7,700 <sup>(</sup>	82,800	901,000
Big Cottonwood	979,500	59,300	12,800	11,200	107,200	1,170,000
Total	4,593,500	478,800	112,200	34,000	528,500	5,747,000
Percent of total damage	80	8	2	1	9	100

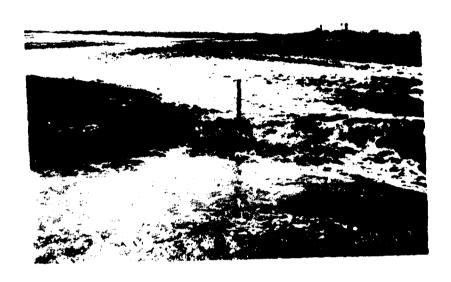
<sup>(1)</sup> This report assumed no urban damages in Marshall, Minnesota, because of Corps of Engineers flood control project.

Many locations in the study area have had flooding from adjoining watersheds, referred to as "crossover flooding". This flooding, as shown on the figure on page 34, forms a floodway nearly parallel to the Minnesota River. The following photograph shows a locally constructed rubble levee to control this flooding. Determining the amount and frequency of flood flow caused by crossover flooding is of primary importance in determining possible solutions and effects on all subbasins. Each of these subbasins has interrelated flood problems that will have to be solved as a group. Attempts to solve the flood problems individually by Public Law 566 watersheds have had limited success because of the interrelated flood problems.



Existing rubble levee constructed to prevent crossover flooding from the Yellow Bank to the Lac qui Parle River basin, December 1967.

Flooding occurs annually on some of the smaller streams. Major floods on the larger rivers occur 1 or 2 years out of 10 and show the greatest frequency of occurrence in April. The following photographs show flooding in the study area.



Cropland flooding in the study area - water was 2 feet deep at one stage



Flooding of highways and roads is a major problem in the study area.

## DRAINAGE

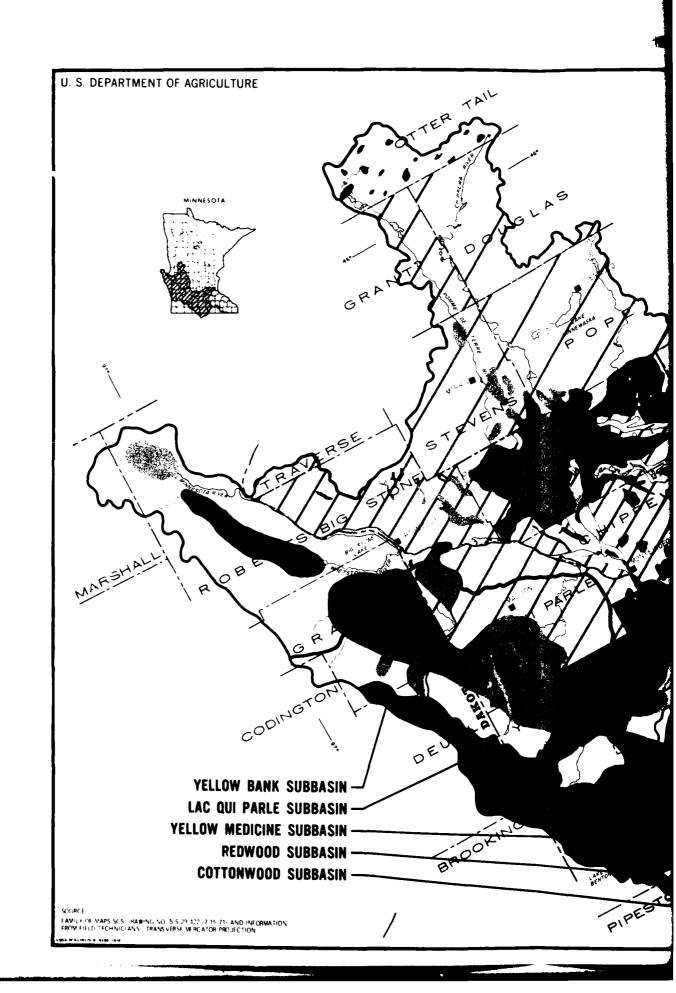
Agriculturally, excess water becomes a problem when it interferes with land preparation, tillage, development of plants, and harvest operations on croplands. These problems contribute to reductions in crop yield, increased production costs, and lower quality of products. Environmentally, wetlands are necessary for waterfowl production and beneficial to wildlife species requiring wetland habitat. Wetlands also provide some natural protection from floods by retarding stormwaters and storing sediment.

Agricultural drainage problems are caused by excess surface and/or subsurface water. Surface drainage problems exist generally where the natural stream drainage pattern is undeveloped. In many problem areas, surface and subsurface drainage systems are interdependent.

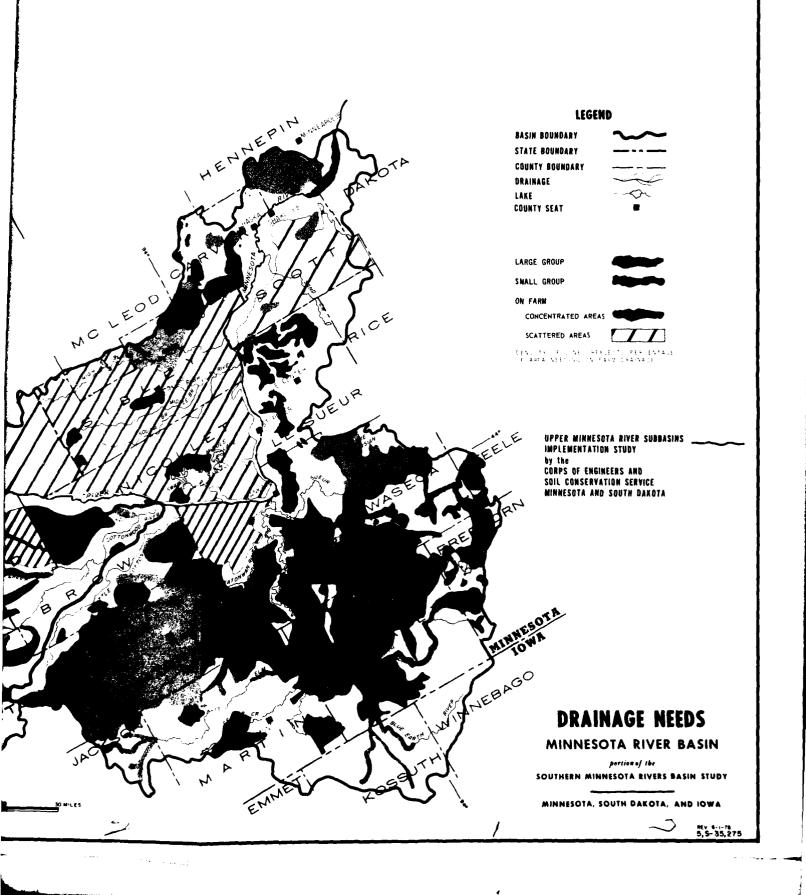
Some soils are subject to flooding and need flood protection to realize their full agricultural productive capacity. In some areas, channels are designed for both drainage and flood prevention. Outlets lacking sufficient capacity are a problem closely related to flood prevention. Adequate floodwater channels ordinarily fulfill the requirements for drain outlets.

On 1,844,300 acres of crop, pasture, and other agricultural lands in the study area, the major limitation or dominant problem is excess water. Wet soils constitute over 70 percent of all agricultural land. Not all of this area having wet soils needs drainage. Instead, present and future drainage needs depend on the desired use of the areas. The potential economic return for the landowner usually determines the use.

On-farm drainage needs total 1,035,000 acres as shown on the following figure. Included are cropland soils which need drainage and additional acres of less than well-drained soils. Some of these on-farm systems will depend on small group or multiland user coordination and/or major project action for outlets at additional costs for completion of effective systems. The acreage needing small group or multiland user coordination is estimated to be 400,000 acres. The total project acreage needing major project action for outlets or to alleviate the major drainage problems is estimated to be 680,000 acres. In addition to this land with dominant drainage treatment needs, considerable acreages of cropland in the basin with wet soils to a lesser extent or soils which are less than well drained may require drainage measures secondary to other forms of land treatment. The photograph on page 41 shows agricultural land which needs drainage.









Drainage is needed in some areas of wet agricultural land

## SOIL EROSION AND SEDIMENTATION

The most significant erosion problems in the basin are sheet and rill erosion caused by wind and/or water runoff. Sheet erosion is the removal of a relatively uniform layer of soil. Rill erosion is the formation of shallow channels that can be smoothed out by normal cultivation.

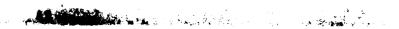
Sheet and rill erosion have caused the gradual removal of the more productive topsoils and, to a limited degree, have exposed the agriculturally less productive subsoils and parent materials (see the following photograph). The loss of topsoil has resulted in reduced natural productivity in some areas. Sheet erosion is a potential problem on all soils under adverse conditions, but especially on sloping soils and soils devoted to cultivated crops. The rate of sheet and rill erosion, as well as gully erosion, depends on many factors - rainfall, slope steepness and length, vegetative cover, soil type, and management.



Sheet and rill erosion cause the gradual removal of the productive topsoil

Erosion is generally more severe in early spring because vegetation on cultivated land is not fully established. Raindrops striking the soil have a large amount of energy, the moving force that begins erosion.

Erosion hazard is the major limitation or dominant problem on 1,075,000 acres of crop, pasture, forest, and other agricultural lands. Unless protected, these soils, constituting nearly 42 percent of all agricultural land in the study area, are subject to moderate to very severe erosion by water and/or wind. It is estimated 876,200 acres (82 percent) of land with this erosion hazard are cropland. There are 98,200 acres of pasture, 49,700 acres of forest land, and 50,900 acres of other agricultural land which also have an erosion hazard, but the problem is not as significant as that existing on cropland. These uses do not generally present an immediate sheet and rill erosion problem because the lands are not cultivated; however, significant amounts of pasture and woodland could experience severe erosion problems, especially if conversion of these marginal lands to croplands continues with the demand for increased production.



About one-third of the cropland with erosion hazards is adequately treated. Soil loss on acres needing conservation treatment exceeds the tolerable levels of 4 tons per acre per year. Almost two-thirds of cropland with erosion hazards is not being cared for in a way that protects the soil resource for sustained production. The following table shows acres of land adequately treated, those needing treatment, and the resultant soil loss per year.

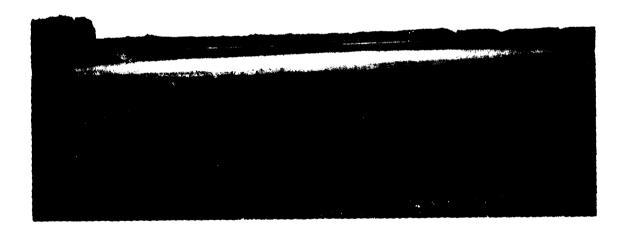
Conservation treatmen			Land adequately treated		needing ment		
Land use	Total acres (1,000)	Acres (1,000)	Percent	Acres (1,000)	Percent	Soil loss tons per year (1,000)	
Cropland	2,142	750	35	1,392	65	7,972	
Pasture	241	66	27	175	73	441	
Forest	54	19	35	35	65	38	
Other	134	<u>95</u>	71	39	29	<u>167</u>	
Total	2,571	930	36	1,641	64	8,618	

Wind erosion is a potential problem in localized areas, but overall is not a major problem. It occurs where topsoils are sandy or light textured, especially during drought years when plant cover is inadequate Airborne soil can act as an irritant to people. Removal of topsoil deposited in ditches and waterways can result in considerable maintenance costs.

Gully erosion, caused by flowing water, forms channels that cannot be smoothed out by normal cultivation. It is accelerated by the lack of vegetative cover and is generally most severe in cultivated areas on rolling topography. Upland gully erosion studies in forest areas show

that undisturbed forest land normally has few gullies and yields little overland flow, even under severe runoff conditions. However, localized erosion problems have resulted from grazing, poor management, or intensive land use above steeply sloping forest land.

Gullies adjacent to the rivers, degrading of ephemeral waterways, and drainage outlets in the subwatersheds are the major concerns (see the following photographs). Loss of land to advancing gullies and the resultant deposition of sediment are problems. Gully erosion destroys land by creating a void where the gully is formed. Gullies lower the utility of the land adjacent to them and damage roads, railroads, buildings, and fences. They are also a hazard to the farm operators and their livestock. In severely gullied areas, the annual gross soil loss can be as high as 400 tons per acre.



Windblown soil erosion in the Cottonwood River basin



Sediment deposits from flooding on Yellow Bank River at mouth of Mud Creek



The annual grass soil loss can be as high as 400 tons per acre in gullied areas

Streambank erosion is the removal of soil from the sides of rivers and streams and occurs principally during floods. The following photograph shows an example of stream erosion in the basin. Other problems include deposition of infertile sediment and dredging costs for maintenance of a navigable channel on the lower several miles of the Minnesota River.



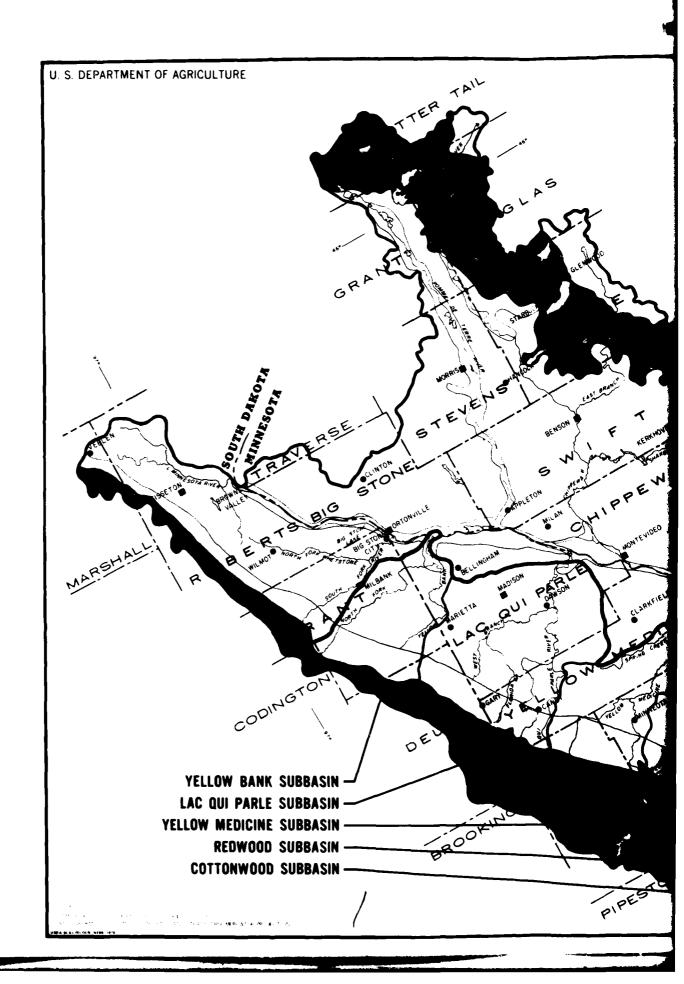
Streambank erosion

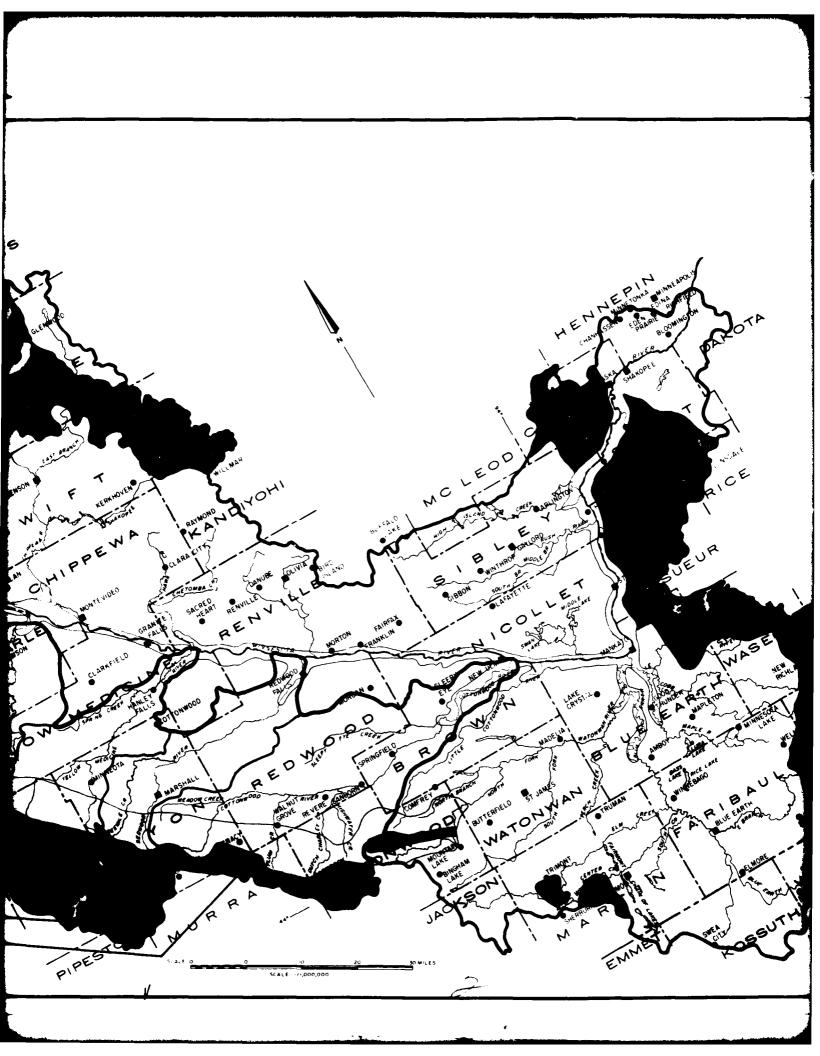
Shoreline erosion is not a major problem in the study area. Wave action causes fluctuation of the water level in certain lakes, resulting in some shoreline erosion. Monetary damages have not been studied.

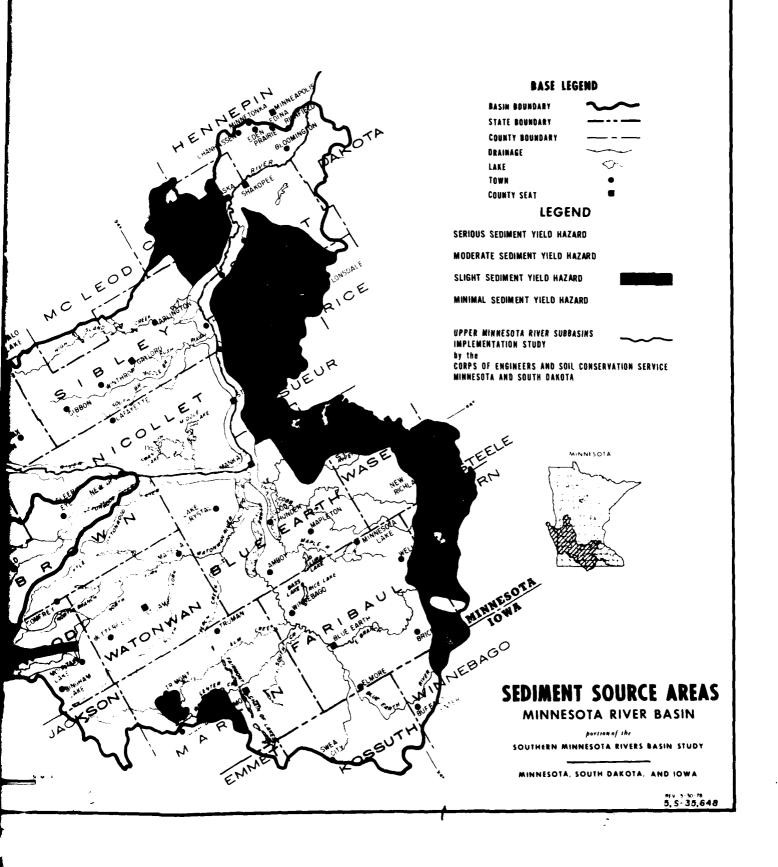
Roadside erosion is a minor problem in contrast to the entire erosion problem. Erosion on road rights-of-way produces a sediment problem and is aesthetically unpleasing. In certain instances, it may create a safety hazard. An inventory of the roadside erosion problem has been completed by the Minnesota Department of Transportation and the Minnesota Chapter of the Soil Conservation Society of America. Problems include undermining of the roadway structure and use of roadside ditches as outlets for agricultural drainage. These problems result in a continued need for maintenance, replacement, and special roadside erosion control measures.

Erosion at construction sites on agricultural lands and urban and built-up noninventory land can be a serious problem if proper precautions are not taken. Erosion rates greater than 30 tons per acre can occur on land with moderate to serious erosion hazards. The small total area in the basin affected by erosion on construction sites at any one time, and the short duration of general construction activities during which soil is susceptible to erosion, make this problem only a small aspect in relation to the total erosion problem.

Sedimentation is a problem in the Minnesota River basin. The sloping face of the Coteau des Prairies is a major sediment source area (see the following figure). Most of the lakes in the basin are undergoing sedimentation to some extent. Major drainage channels require periodic cleaning to remove accumulated sediment. The Minnesota River carries a moderate sediment load even under normal conditions because of the high percentage of cropland in its drainage area. It is a major source of sediment pollution to the Mississippi River above Lake Pepin. Above its junction with the Minnesota River, the Mississippi River is practically a clear water stream, even at flood stage. Partially because of the sediment carried by the Minnesota River, the Mississippi River is one of the few major rivers that has an increasing sediment load per unit of watershed area as the drainage area increases.







The major source of sediment in the study area is sheet erosion from cropland. Other types of upland erosion, such as gully and roadside erosion, are locally severe but do not constitute a significant source of sediment pollution. Streambank erosion is not a major source of sediment because erosion resistant material is present. Wind erosion on bare farmland is a major source of dust which has an adverse effect on air quality in the basin. Airborne sediment pollution is a problem principally in the fall and early spring.

The present emphasis in conservation farming is protecting the soil resource base for continued productivity. A dramatic decrease in sediment pollution would require a combination of conservation farming measures designed principally for sediment abatement and mechanical control measures such as desilting dams to trap sediment.



Sediment fills lakes, reduces stream capacity, and is a major water pollutant

## PRESENT STATUS AND NEED FOR LAND STABILIZATION AND CONSERVATION

Protection and management measures, including all types of conservation treatment and practices, are a basic need in the conservation, development, and use of land and water resources. These measures are needed for crop, pasture, forest, and other agricultural lands throughout the basin.

Soils in the area are classified as follows:

- 1. Class I soils have few limitations on their use. They are deep, well-drained soils which are highly responsive to fertilizer and are suited to intensive cropping.
- 2. Class II soils have some imitations which reduce the choice of plants and require moderate conservation measures. The limitations, however, are few and the measures are easy to apply. Like Class I, these soils respond well to fertilizer and are very productive with proper management.
- 3. Class III soils have severe limitations which reduce the choice of plants and require special conservation practices. The limitations restrict the amount of cultivation, time of planting, kind of tillage, choice of crops and harvesting.
- 4. Class IV soils have very severe limitations which restrict the choice of plants and require very careful management. Although these soils are cultivated, careful management is required and conservation practices are difficult to apply and maintain. Class IV soils may be well suited to only two or three of the more common crops, and production is generally low.

5. Soils in Classes V through VIII are generally not suited for cultivation and are mostly used for pasture, woodland, and wild-life food and cover areas. Class V land is nearly level but wet and subject to flooding and ponding hazards, which are impractical to remove. Class VI soils are such that it is practical to apply pasture improvements including seeding and fertilization. Such practices are generally considered impractical on Class VII soils. Soils in Class VIII have possible uses for wildlife, watershed protection, or recreation, but are unsuited for commercial production.

The four kinds of limitations recognized in Minnesota at the subclass level are:

- E Susceptibility to erosion is the dominant problem or hazard. Susceptibility and past erosion damage are the major factors factors for placing soils in this category.
- W Excess water is the dominant hazard or limitation. Poor soil drainage, wetness, high water table, and overflow are the criteria for determining which soils belong in this subclass.
- S Root zone limitations are the dominant hazard or limitation. Soils in this subclass have such limitations as shallow depth, low available water capacity, or slow permeability.
- C Climate (temperature) is the only major hazard limiting use.
   Much of Minnesota has a growing season of less than 120 days.

The class and subclass provide information about the degree and kind of limitation. Subclasses are not recognized in class I.

Limitations imposed by erosion, excess water, shallow soils, stones, or low available water capacity can be modified or partially overcome and will take precedence over climate in determining subclasses. The dominant kind of limitation or hazard determines the classification. Where two kinds of limitations that can be modified or corrected are essentially equal, the subclasses have the following priority: E, W, S, C.

The following table categorizes soils in the study area by class and subclass.

Acreage in the study area inventoried by land capability class and subclass (1967 Conservation Needs Inventory)

Class	class (1967 Conservation Nee Subclass	Acres
01433	Subclass	Acres
I		264,846
II	E	836,997
	W	731,051
	S	59,290
	<b>C</b> .	0
	Total	1,627,338
III	E	190,321
	W	199,807
	S	54,622
	С	0
	Total	444,750
IV	E	60,102
	W	1,328
	S	3,485
	Total	64,915
v	E	0
	W	13,319
	Total	13,319
VI	E	23,743
	W	54,470
	S	1,203
	Total	79,416
VII	E	31,780
	W	0
	S	20,735
	Total	52,515
III	W	20,239
	S	3,194
	Total	23,433
acres inventor:		2,570,532

About 93 percent of the study area's land resources is in Classes I through IV and is generally suited for cultivation with practical land treatment. The 6 percent of the remaining land in Classes V through VII is suitable for grazing or forest with proper management. Less than 1 percent of the area's inventoried land has limitations precluding its use for commercial production.

Land in the area is highly productive for agricultural crops. The two most productive SRG's (Soil Resource Groups) contain 74 percent of the agricultural land. The most prevalent SRG contains 2.0 million acres of deep, medium to moderately fine textured upland soils. Soils in this SRG are either capability Class I or II and require only limited land treatment. These soils are well suited for corn and soybean production and can be expected to sustain high yields with proper management.

Twenty-three other SRG's are used to analyze production capabilities of the remaining 26 percent of the land. A much wider range of crops. crop yields, land treatment, and management practices is associated with these soils. Approximately 21 million acres is in Classes II, III, and IV, and is suitable for cultivation when adequately treated. Some of these soils have unique characteristics making them suited for production of various specialty crops, as well as the more common field crops. The remaining 168,683 acres is in Classes V through VIII, which have hazards limiting use to pasture, forest, recreation, or wildlife cover and protection.

Fertility management is generally needed even on Class I soils. Crop residue management and minimum tillage are desirable practices for maintaining and building soil structure on all classes of land (see the following photograph).



Crop residue will protect and improve the soil

The 1967 Soil and Water Conservation Needs Inventory was used as base data for the study area. An update to 1974 was done using existing trends and conservation accomplishments through the judgment and knowledge of persons within individual counties. It is not based on statistical sampling as was done in 1967.

Of the 2,570,532 acres of agricultural land in the study area, 951,907 acres, or 38 percent, is adequately treated.

Eighty-three percent of the agricultural land in the study area, or 2,142,720 acres, is devoted to crop production - 35 percent of all cropland is adequately treated; 23 percent has a major need for residue and annual cover; 18 percent needs sod in rotation or a comparable level of management; 12 percent needs contouring; 15 percent needs strip-cropping, terraces, or diversions; nearly 2 percent needs conversion to permanent cover; and 31 percent has major needs of improved drainage.

When erosion hazard is slight, it was assumed that residue, annual cover, or minimum tillage (see the following photograph) was the most likely alternative for treatment. When the degree of erosion hazard increased to moderate, sod in rotation or contouring was selected. Sod in rotation has been used as a soil productivity maintenance practice and also has merits in reducing susceptibility of soils to erosion as part of the overall rotation. With increasing demand for grain crops and continued availability of commercial fertilizers, the use of sod in rotation as a practice will likely decrease.



Minimum tillage protects the soil from erosion and conserves moisture

The major treatment need for cropland soils with a wetness problem was generally assumed to be surface and subsurface drainage systems.

About 10 percent, or 248,460 acres, of the agricultural land in the basin is devoted to pasture - 27 percent of the pastureland is adequately treated, 60 percent needs protection from overgrazing

only, 21 percent needs improvement only, 12 percent needs reestablishment of vegetative cover, 6 percent needs brush control and improvement, 7 percent is not economically feasible to treat, and only 75 acres needs a change of land use to woodland.

Only 53,550 acres or slightly more than 2 percent of the basin is devoted to forest and woodlands - 36 percent of the forest land is adequately treated, 23 percent needs establishment and reinforcement, 39 percent needs timber stand improvement, and 2 percent is noncommercial forest needing varied treatment. All commercial forest in the basin is grazed and needs treatment for grazing; 30 percent needs forage improvement.

Five percent of the agricultural land in the basin is devoted to other land uses. Other land is non-Federal rural land not classified as cropland, pasture or forest and includes farmsteads, farm roads, feedlots, ditch banks, fence rows, small stock ponds, small shelterbelts, certain wetlands, wildlife lands, rural nonfarm residences, borrow acres, churches, and cemeteries. Seventy-one percent of the other land in the basin is adequately treated. The remaining 29 percent needs varied forms of treatment including erosion control, farmstead windbreaks or shelterbelts, and agricultural waste management systems.

#### **POLLUTION**

In response to the Nation's needs and desire to improve the environment, Congress enacted the Federal Water Pollution Control Act Amendments of 1972. These amendments established a national goal of achieving water quality adequate to allow fishing and swimming in all of the Nation's surface waters by 1983. The Minnesota Pollution Control Agency has responsibility for determining the best current uses to which the State's waters may be put and the quality of the waters necessary to meet these uses.

Soils throughout the study area are considered highly fertile consisting of sandy to clay-type loams and tills. Many of these soils are highly susceptible to water and wind erosion. Both erosional types contribute significantly to nonpoint source pollution problems.

Many of the lakes in the study area are shallow, warm, and turbid and extremely susceptible to eutrophication. These lakes have high phosphorus, nitrogen, and alkalinity levels. The most probable source of these nutrients is overland runoff across erodible soils in agricultural fields.

In 1969, farmers in the Minnesota River basin purchased \$2,417 of commercial fertilizer (a possible source of nutrient pollutants) per square mile compared to a State average of \$1,027 per square mile. In that same year, Minnesota River basin farmers spent \$856 per square mile for nonfertilizer chemicals.

Improvements needed in fishing lakes are shown in the following table.

					Improv	ement n	ing lake eeded			
County	Lake(2)	Surfac area	e Depth	S11t	Weeds	Algae	Fluctu- ations		Water quality	Public access
Minnesota			i l		Í	İ				
Brown	Boys (Boise) (8-95)	;	x	x	х	х				
	Sleepy Eye (8-45)	i	X	х	х	x		х		
Cottonwood	Bean (17-54) Double (17-56		x	х			X	х	,	x
	Long (17-48)	1	X X	X ;		х	X X	X X	Х	
Lac qui Parle	Lac qui Parle (37-46)			х		х			x	
	Pegg (37-224) Salt (Rosabel (37-229)	)			·		x		х	х
Lincoln	Benton (41-43 Hendricks (41-110		x x	x x		x x	x	X X		x
	Shoakatan (41-89)		х	х		х		х		
Lyon	Cottonwood (42-14) Goose (42-93)	Х						x		
	(SWC) School Grove (SWC)(42-2) West Twin		x			x		x	х	
	(42-74)	-								
Yellow Medicine	Miedd (87-61) Spellman (87-60)	X	X X				x	х		Х
South Pakot	4	}				ļ				
Brookings	Hendricks (41-110		х	х		x	x	x		x
	Oak (C)	) <sub> </sub>	x	х		х			х	
Dou <b>el</b>	Cochrane (A,	•	X	X				•	x	

<sup>(1)</sup> As designated by local people and Minnesota Department of Natural Resources.

<sup>(2)</sup> Identification numbers, Minnesota Department of Natural Resources.

A number of the lakes have seasonal residences along their shores. The septic tank effluent from these residences is partially responsible for the pollution of the lakes.

The Minnesota Pollution Control Agency determined that, of the 133 communities in the Minnesota River basin, 29 provide adequate sewage treatment, 25 are expected to be able to provide adequate treatment by making various operational or maintenance improvements to existing facilities, 60 must upgrade or replace their facilities, and 19 have no facilities other than private septic tanks. Of the 46 industrial dischargers in the basin, 13 provide adequate treatment and 33 are inadequate. (1)

A more perplexing problem is that of nonpoint sources of pollution. The extent of actual nonpoint source pollution depends on natural conditions and control measures, or lack of such, assicated with such land uses as tillage, chemical applications, livestock containment, and construction. Lack of proper land treatment practices has resulted in increased pollution in the basin.

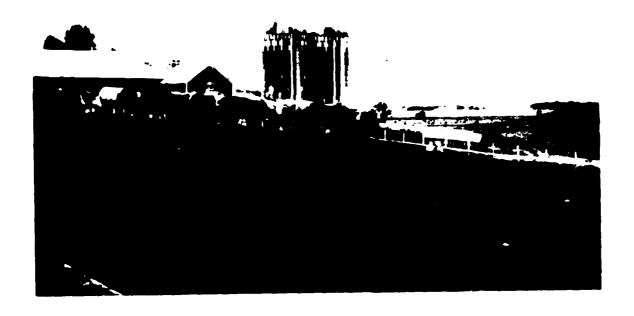
Although total livestock numbers have not changed significantly, new technology and management practices have significantly changed their concentration. The general trend of larger and more concentrated feeding areas has resulted. With this trend has grown the concern over environmental effects on surrounding areas and water resources.

In an attempt to indicate the level of concentration in the basin, the number of feedlots and number of cattle by feedlot size were estimated. Using 1969 Agricultural Census and Statistical Reporting Service data, 174,347 head were being fed on the area's 3,405 feedlots. Approximately 20 percent of fed beef was in 5 feedlots with over 1,000 head. Another 42 percent was fed in feedlots of 500 to 1,000 head each. The remaining 38 percent of the basin's fed beef was grown in smaller feedlots not exceeding 500 head.

<sup>(1)</sup> Water Quality Management Basin Plan, Minnesota River Basin, Minnesota Pollution Control Agency, June 1975.

A number of feedlots are in areas with direct accessibility to surface waters. In many areas, pastures used for livestock production are undesirable because livestock have direct access to streams and lakes. The Minnesota Pollution Control Agency found that pollution potential from livestock production in the study area is high.

It is estimated that 2,000 livestock enterprises are potential nonpoint sources of pollution. In the future, as municipal and industrial point source effluents are improved and point source impacts are determined through increased monitoring, the effects of nonpoint sources on streams will become even more evident.



Farm barnyard potential for nonpoint pollution in the area (1972)

#### FISH AND WILDLIFE

The major problems for wildlife within the basin are continued loss of habitat to other land uses and deteriorating quality of remaining habitat acres. These problems result from increased demands on land and water resources, primarily for agricultural production and urban expansion.

The major losses of woodland are to recreation, country home sites, and expanded crop production. The loss of woodlots, windbreaks, and brush cover between and within fields is the most detrimental to woodland wildlife species. These losses eliminate vast acres of food producing cropland from use by these species which must have protective cover near their food sources. As a result, animals are mostly limited to lands bordering the wooded river bottoms where cover is available.

The quality of woodland habitat suffers from overgrazing, inadequate ground cover, improper distribution, and stand maturity. Most of the present windbreaks are single row and lack coniferous species. Although these windbreaks provide travel lanes, they do not provide adequate protection from winter storms or predators.

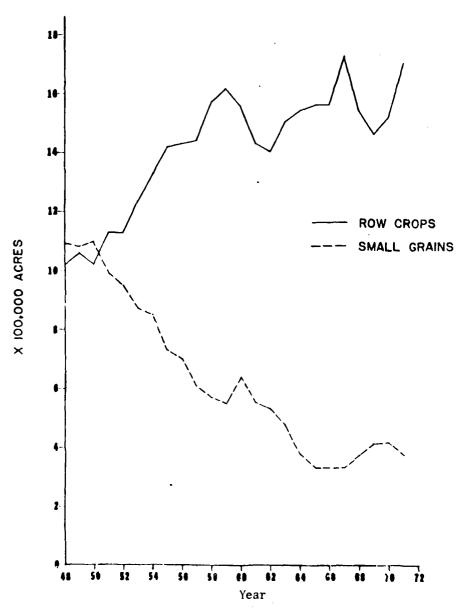
The population levels of woodland wildlife which are desirable and compatible with agricultural production within the basin must be determined. Incentives are needed to encourage private landowners to retain and improve their woodlots and windbreaks and manage woodlands for wildlife. Multirow windbreaks and small block plantings of trees and shrubs are needed in the heavily cropped portions of the basin to replace past and current losses and provide a better distribution of woodland acres.

Research in the study area by the Minnesota Department of Natural Resources and other supporting data were reviewed and summarized to determine contributing factors for the downward trend of pheasant populations. Problems and needs of pheasant habitat are similar to those of most upland species. Therefore, they are presented as being representative for the upland wildlife group.

Land use trends, predation, and climatic conditions were cited as the major factors involved in the declining pheasant population. Shifting land use was the major impact, in that less cover was available for protection from predation and severe weather. Considerable natural cover, including residual herbaceous cover once found along fencelines, borders, ditches, and odd corners, has been lost to agricultural uses. The departure from crop rotation systems to continuous row cropping has drastically reduced the quantity of small grain acres available for nesting habitat (see the following figure). Pasture and hayland acres have steadily declined as well. While lightly grazed pasture provides good nesting cover, most remaining pastureland in the basin is moderately to heavily grazed. Legume hay also attracts nesting birds. However, since hay is moved early in June, nest failure is high and many hens and chicks are killed or injured during mowing. These combined losses of "safe" nesting habitat are cited as primary factors in the decline of pheasant numbers. (See the figure on page 64.)

# TRENDS IN AGRICULTURAL LAND USE IN RELATION TO PHEASANT NESTING HABITAT 1948-1971

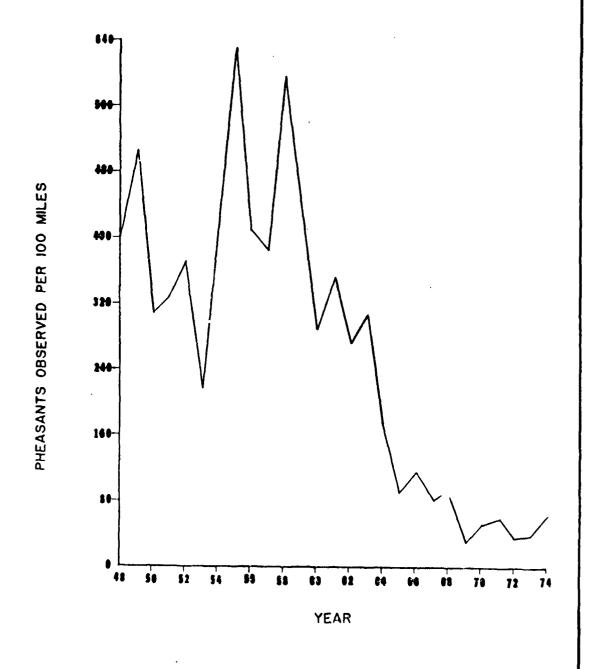
STUDY AREA



# AVERAGE AUGUST ROADSIDE PHEASANT COULT

STUDY AREA

1948-1074



Although corn and soybeans are major food items in the pheasant's diet and abundant supplies are an asset, the availability of waste grain in winter is largely determined by the amount of fall plowing and the snow depth which remains over winter. Virtually all the row crop acres are fall plowed, eliminating those acres from use for winter food or cover. The continued loss of woodlots, windbreaks, and brush cover has also seriously reduced the availability of winter and escape cover for pheasants and other upland species.

The major needs for upland wildlife habitat per section are: 50 to 75 acres of properly managed grass or legume cover, at least one stand of dense coniferous and low deciduous tree cover of 1 to 15 acres, and standing food plots of 1 to 3 acres near established winter cover. Greater use of soil suitability information should be made in land use decisions. Many areas of rough, rolling land with complex slopes are better suited for grassland, hay, or pasture than for grain crop production.

Wetland habitat in the study area continues to decline. The major problem lies in the inherent conflict with agricultural drainage needs. Wetlands which keep groundwater levels high or restrict surface drainage tend to reduce production on surrounding croplands. Although this conflict has existed since early settlement of the basin, recent increases in production costs and national emphasis on all-out crop production have greatly intensified the problem. Many type I, II, and III wetlands are cropped whenever dry conditions exist (see the following tables). Where types III, IV, and V wetlands remain intact, surrounding nesting habitat is generally lacking due to overgrazing, burning, or encroachment by croplands. Eutrophication and sedimentation have accelerated the evolution of many wetlands to more shallow, drier types.

Summary of wetlands 10 acres or larg	ger in the study area
Wetland types	Total acres
Dry or drained basins	29,593
Partially drained basins, some wetland remains	1,964
Type II	157
Type III	4,201
Type IV	16,891
Type V	9,374
Type VI	28
Unclassified	249
Total	32,864

Federal agencies	,
Management agency	Total acres
Minnesota	
Federal (U.S. Fish and Wildlife	
Service(1)	1,042
State (2)	10,926
South Dakota (3)	
Federal (U.S. Fish and Wildlife	
Service)	1,144
State	1,047

Total (State and Federal)

Federal and State

All managed acres (wetlands and upland)

Wetlands in the study area owned or managed by State or

14,159

45,799

<sup>(1)</sup> All wetland acres, regardless of size. From information provided by U.S. Fish and Wildlife Service, wetland acres average 39.86 percent of all acquired acres, and 24.17 percent of all easement acres on waterfowl production areas in Minnesota.

<sup>(2)</sup> All wetland acres, regardless of size. Wetland acres were calculated at 30 percent of all managed acres within the basin by the Minnesota Department of Natural Resources.

<sup>(3)</sup> All wetland acres, regardless of size. Wetland acres were calculated at 33 percent of all managed acres, based on information supplied by South Dakota.

The need for wetland preservation is indicated by the priority placed on the region by State and Federal acquisition programs. Acceleration of these programs is needed. The greater need, however, is to provide incentives to private landowners to retain and manage their wetland acres as wildlife habitat. Approximately 60 percent of the remaining wetland resources in the study area is privately owned. Without the support and cooperation of private landowners, attempts to preserve those wetlands will fail. Wetland areas are shown in the following photographs.



A productive wetland area



Potholes and wooded creeks in Deuel County, South Dakota, 1972



Man-made lake and wetlands in the lower Lac qui Parle River

The study area is oriented toward agricultural production and will remain so in the future. The acres of land available to provide adequate habitat for wildlife are limited; thus, multiple use of those acres by a variety of species is imperative. The needs of the various species of wildlife are interrelated and interdependent. The main objective of wildlife habitat improvement should be establishment of vegetative diversity. Such diversity should provide stratification from ground cover (grass) to overstory (trees) and be distributed in a manner which maximizes "fringe" with other vegetative types. These patterns of interspersed vegetation can only be achieved with full cooperation between wildlife agencies and private landowners who control the majority of land and, therefore, the ultimate fate of the basin's wildlife resources.

The study area's fishing waters share common problems - sedimentation, rough fish invasion, and eutrophication. Removal of shoreline and streambank vegetation by grazing, development, and other causes has not only created erosion problems, but has reduced spawning habitat and protective shaded areas. Erosion from croplands carries pesticides and nutrients, as well as silt, into most of the lakes which compound the winterkill and eutrophication problems inherent to the region. Siltation is a major problem in the rivers and streams. Carp and other rough fish problems are nearly universal. While total production of fish generally increases in carp infested waters, it is usually at the expense of game fish. The table on page 58 indicates improvements needed on the fishing lakes in the study area.

Land treatment practices are needed to reduce erosion rates to acceptable levels.

# RECREATION

The demand for outdoor recreation opportunities has steadily increased in the past two decades. Measuring that demand accurately and predicting future needs is a difficult task. Changes in economic conditions, population, leisure time, and especially user attitudes can produce wide variations in activity levels.

Current methodology is a problem in itself. Basic data concerning actual use of facilities by the public are often not available, primarily because of insufficient funding for user surveys. Space standards for the different activites are not universally accepted. and usually vary by planning agency from region to region. No satisfactory method is available to evaluate quality of recreation experience in quantitative terms for planning use. A better understanding of man's need for recreation and his expectations from it is needed.

Projected future levels of participation in recreation activities in the study area and the resulting resource requirements are listed in the following tables. Water-based activities are not equally available within the study area. Large deficiencies in lake acres are projected in the area (see the following table). Problems with depth, sediment, eutrophication, and water quality restrict the use of many lakes for recreation purposes. Conflicts between incompatible activities such as water-skiing and boat fishing are also common. There is a need for cooperative area-wide lake surveys to identify those which can feasibly be improved by dredging, increased outlet elevations, upstream sediment traps, and other improvement practices. Suitability groupings for lake associated activities could then be determined, and recommendations for proper use or uses of the lakes could be made.

Most water enhanced and land based facilities are deficient areawide, and some represent important priorities for additional development. Developed miles of nature trails are less than 10 percent of future needs. Snowmobile trails and developed acres for picnicking and camping represent less than 10 percent of those needed by year 2000 (see the tables on pages 71 and 72.)

Projected outdoor recreation activity occasions expected to occur on an average weekend day - year 2000, study area

Activity	Occasions
Swimming	44,669
Golf	5,053
Tennis	5,158
Outdoor games	78 <b>.8</b> 15
Walking for pleasure	11,228
Bicycling	54,365
Horseback riding	2,879
Trap and target shooting	840
Fishing	11,836
Boating	3,755
Canoeing	3,424
Water-skiing	17,751
Sailing	607
Camping	18,761
Hiking	894
Picnicking	18,456
Nature walks	19,820
Snowmobiling	15,336
Snow skiing	713
Small game hunting	5,198
Large game hunting	14,953
Waterfowl hunting	3,343

Resources necessary to provide future (year 2000) recreation levels
with acceptable space standards, study area(1)

Facility		
ractificy	Number	
Swimming beach		
Water (acres)	15.1	
Land (acres)	75 <b>.5</b>	
Pools (1,000 square feet)	502.5	
Golfing (rounded to even 9-hole course	2)	
Holes	162	
Acres	1,620	
Tennis (courts)	161	
Outdoor game fields (acres)	904.7	
Trap and target shooting (acres)	420	
Fishing - water (acres)	26,631	
Boating - water (acres)	5,007	
Canoeing - stream (miles)	214	
Water-skiing - water (acres)	44,378	
Sailing - water (acres)	809	
Camping - sites	8,934	
Camping acres	•	
Developed	938.1	
Support	4,690	
Hiking trails	17.9	
Picnicking tables	3,076	
Picnicking acres	•	
Developed	615.2	
Support	3.076	
Nature trails (miles)	396.4	
Snowmobile trails (miles)	511.2	
Hunting small game (upland acres)	41,584	
Hunting large game (upland acres)	956,992	
Hunting waterfowl (wetland acres)	15,044	

<sup>(1)</sup> Standards not available for bicycling, horseback riding, or walking for pleasure. Acres for large game hunting are based on a 2-day season, which has been established in the Minnesota River basin area in recent years.

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Outdoor recreation facility needs, 1975 and 2000

	Amo	unt(1)
Facility	1975	2000
Swimming beach	•	
Water (acres)	-1.0	-2.7
Land (acres)	-63.0	-71.6
Pools (1,000 square feet)	-381.6	-438.6
Golfing (rounded to even 9-hole course)		
Holes	-	-18
Acres	-430.0	-610.0
Tennis courts	-42	-112
Outdoor game fields (acres)	-487.5	-609.7
Fishing water (acres)	<b>-9</b> 79	<b>-5,</b> 693
Total recreation water (acres)	-13,837	-40,682
Camping - sites	-1,484	-4,202
Camping - developed (acres)	-331.3	-875.0
Picnicking - tables	-1,417	-2,221
Picnicking - developed (acres)	-411.9	-572.7
Hiking trails (miles)	+24.1	+23.1
Nature trails (miles)	-318.5	-383.4
Snowmobile trails (miles)	-447.5	-475.2
Hunting small game (upland acres)	-10,216	-9,944
Hunting waterfowl (wetland acres)	-1,569	-885

<sup>(1) -</sup> indicates deficiency.

Development priorities (1) - outdoor recreation

		rity	
Facility	1 <b>9</b> 75	2000	
Swimming beach			
Water	10	9	
Land	1	1	
Poo1	2	2	
Golfing			
Holes	10	9	
Acres	8	7	
Tennis courts	6	3	
Outdoor game fields	4	4	
Fishing water	10	8	
Recreation water	8	5	
Camping			
Sites	2	1	
Acres	1	1	
Picnicking			
Tables	4	3	
Acres	1	1	
Hiking trails	10	10	
Nature trails	1	1	
Snowmobile trails	1	1	
Hunting small game	8	8	
Hunting waterfowl	9	10	

<sup>(1)</sup> Based on percent of need being supplied by present facilities. Example; if present facilities are 0-10 percent of those needed, priority is No. 1; 10-20 percent, priority is No. 2; 90-100 percent, priority is No. 10, etc.

<sup>+</sup> indicates surplus.

Public access to the various facilities is a key factor to the use of recreation resources. The major needs for increased public access are to lakes and streams and to private lands for hunting. Many of the more popular lakes will continue to be overcrowded until demands are redistributed to areas underused or presently inaccessible. Problems of hunter and recreationist abuse of privileges have closed much of the private land to public access. The study area has insufficient acres of public hunting lands to meet its needs for small game and waterfowl hunting. The entire area must depend upon private lands for big game hunting. Stream fishing and canoeing also require some access to private lands. Thus, cooperative programs which emphasize user responsibilities and provide incentives to landowners to allow public use of their land for hunting and other activities are needed.



Public access is a key factor to the use of recreational resources

Hunting activity fluctuates with supplies of game, hunter density, established seasons, bag limits, and weather conditions. The problems and needs for supplying adequate numbers of game species are discussed in the wildlife section of this chapter. Hunting, as a socially acceptable form of outdoor recreation, has become a controversial issue in recent years. All segments of society need to fully understand the implications of this issue on wildlife populations and management and on hunters and nonhunters alike. Greater emphasis on nonconsumptive uses of wildlife, such as birdwatching, photography, and nature study, is needed in wildlife management programs. An intensive information program stressing the interrelationships between man and the ecosystem, the actual effects of regulated hunting upon wildlife populations, and sportsman ethics should become an important part of all natural resource budgets.

The development of recreation facilities and associated resources in the basin will require a coordinated program, enlisting the full ecoperation of all governmental levels and the private sector. Study area priorities may change when placed in a context of State and regional needs. The 1974 Minnesota SCORP presents a framework for such a coordinated program and provides the necessary guidance for future action. As a step in achieving a properly developed recreation system, SCORP is a major accomplishment. It deserves the full support of all resource and recreatior interests, both in cooperative planning and providing adequate future funding.

#### CULTURAL RESOURCES

Residents of the upper Minnesota River basin are concerned about the aesthetics of the area and have made efforts to preserve and develop natural and cultural areas and features of aesthetic and scientific value. Efforts to preserve natural wildlife and vegetation will contribute to an understanding of the basin's changing environment during prehistoric and historic times. A number of structures and sites have been formally

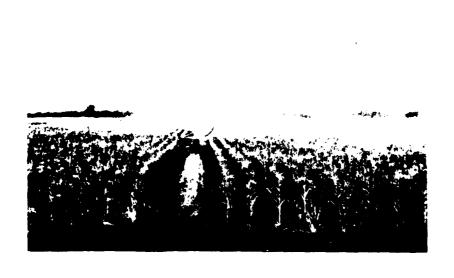
recognized for their cultural significance and included on the National Register of Historic Places. Other sites, some yet to be discovered, are potential candidates for the register. All project impact areas will be investigated to identify and evaluate potentially significant cultural remains. Before any project features are constructed, all significant cultural resources that cannot be avoided, protected, or relocated will be recovered through a scientific data recovery program. Cultural resources that are preserved or recovered will be an important data base for public interpretation and future scientific research.

The geologic resources of the basin must also be developed further. The channel of the ancient River Warren has been recognized as a Nationally Registered Natural Landmark. Also of scientific and interpretive interest in the Minnesota River valley near Morton and through the Granite Falls area are exposed areas of some of the world's oldest bedrock, dating back 3.8 billion years.

#### WATER SUPPLY

In general, no municipal water shortages exist. Few are anticipated with projec 'growth.

In 1970, gross water requirements for irrigation were 310 acrefeet. To satisfy economic potential for irrigation in 2020, it is projected that 140,000 acre-feet of water will be required. In addition, water withdrawals for livestock and rural domestic uses are projected to increase from 10 mgd in 1960 to 30 mgd in 2020. A portion of this requirement for livestock water is provided by dugouts and ponds.

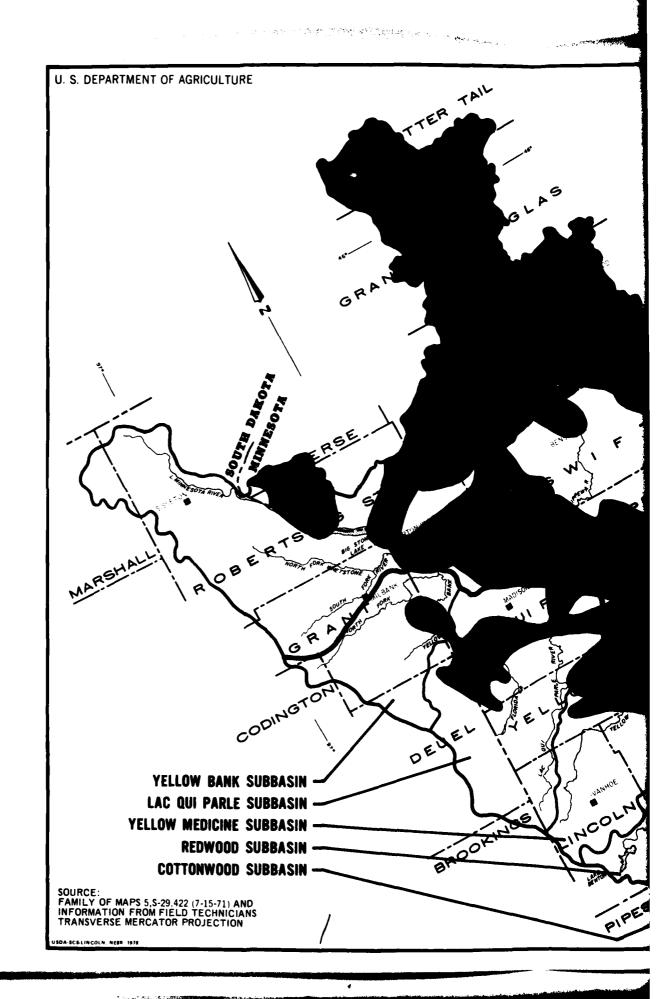


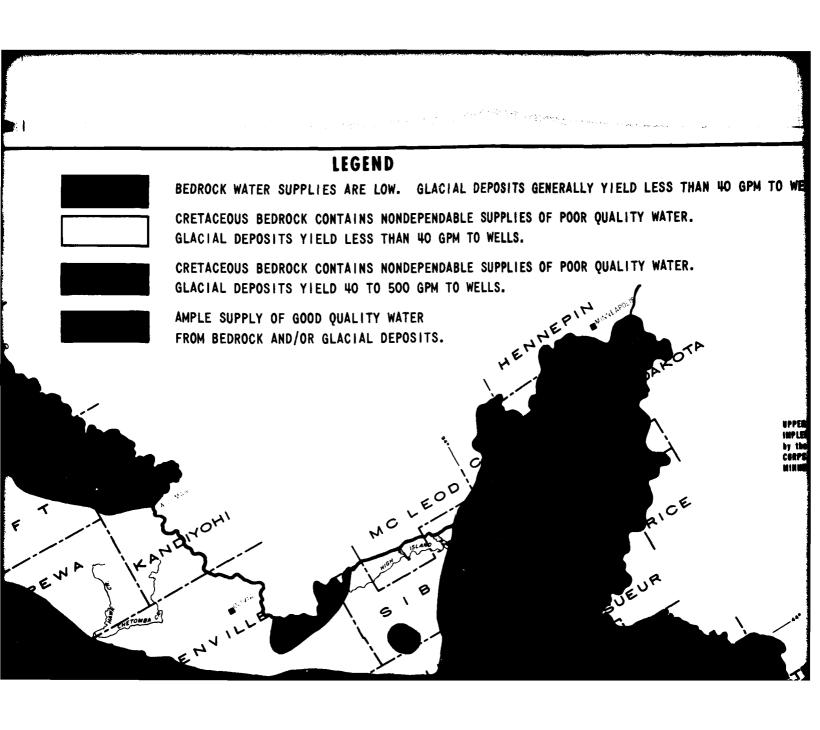
Sprinkler irrigation provides water for crops during dry years

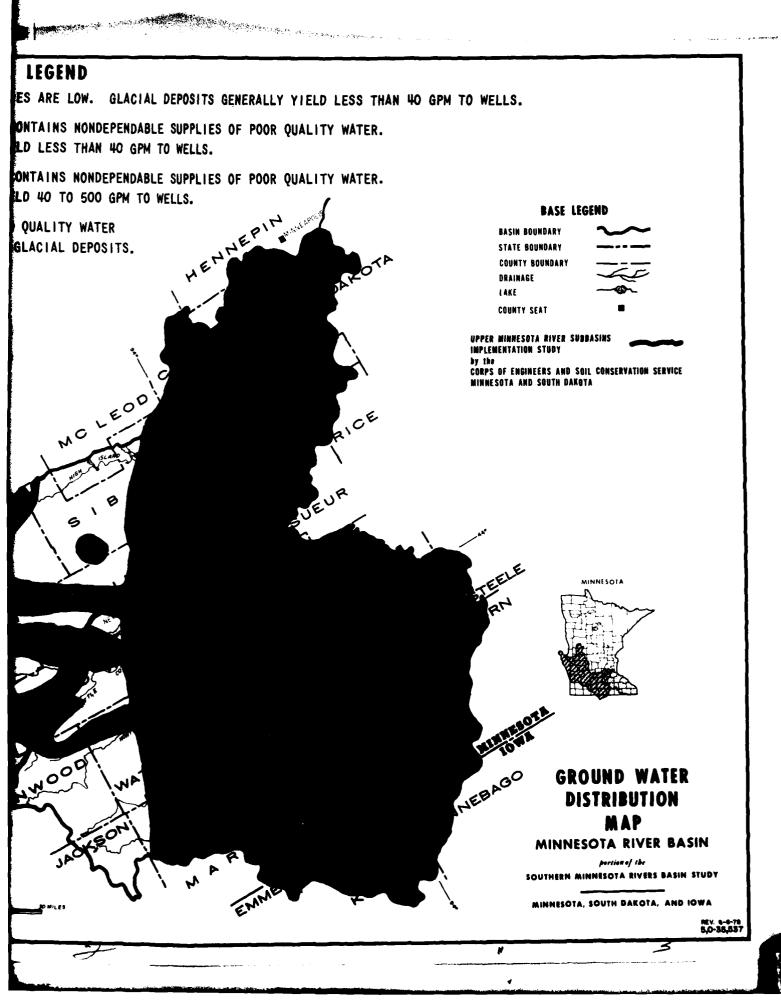
The U.S. Geological Survey is conducting groundwater studies to determine irrigation potential in the Minnesota River basin. The Bonanza Valley Area Ground Water Study in Pope County has been completed, and the Lake Emily (Pope County) and Pomme De Terre Sands (Big Stone, Chippewa, and Grant Counties) groundwater studies are in progress. Although groundwater supply is adequate, the projected demand for 115 mgd of irrigation water by 2020 is significant, and additional groundwater studies must be completed before an accurate assessment can be made. However, useful conclusions can be made as to which areas are probably not feasible to irrigate.

The areas shown in red and yellow on the map on page 77 generally would not support irrigation developments from on-site groundwater supplies. Irrigation in these areas would require large-scale development with water being supplied by import or from large water impoundments. The following map shows groundwater distribution in the basin.

CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT F/6 13/2 UPPER MINNESOTA RIVER SUBBASINS STUDY (PUBLIC LAW 87-639) (DRAF--ETC(U) AD-A119 415 **SEP 78** NL UNCLASSIFIED 21+ **3** 







#### WASTEWATER MANAGEMENT

Based on available information, a basin-wide analysis to identify a wastewater management plan should be undertaken. This plan should follow the broad outlines of the U.S. Environmental Protection Agency Section 208 Water Quality Planning. Detailed plans for specific urban areas should follow Section 201 of Public Law 92-500.

### PUBLIC HEALTH AND SAFETY

The health and safety of residents in the study area are directly affected during major flood periods. A serious threat to life is always present during floods as a result of flooded residences and related potential for drowning, electrical shocks, injurious falls, and injury during attempted movement over flooded thoroughfares. Other threats to public health include impedance of local traffic flow because of sight-seers, backup of sewers into basements, migration of vermin from flooded areas, contamination of private water supplies, a restricted degree of sewage treatment, the potential for a major fire caused by possible movement of the numerous fuel storage tanks and pipelines, and increased vector production during a major flood. An example of a vector problem is the mosquito and corresponding encephalitis problem.

# LAND USE

Land use should follow a logical pattern depending on the limitations of the soils. When there is a deviation from this pattern, problems are usually encountered that will require special construction techniques or management to correct.

No tremendous conflict exists between rural and urban land in the study area. Problems that result from scattered development are:

- Conflicts between development and preservation of natural areas.
- 2. Loss of agricultural land to residential, commercial, and industrial development.
- 3. High cost of providing services for unguided urban growth.
- 4. Environmental impacts of development on unsuitable land.
- 5. Potential effects of higher energy cost on type and distribution of future urban/rural areas.
- 6. Erosion and sediment from developing areas.
- 7. Conversion of wildlife habitat to marginal agricultural land.

Some of the problems of the urban fringe areas are also prevalent in rural areas, especially where the intensive use of rural lands for agriculture is interfering with maintaining areas for environmental and ecological reasons. Other land use problems in rural areas are the production of crops on areas with steep and erosive slopes, wet soils, lack of conservation land treatment, overgrazed pastures that border streams and result in streambank erosion, and the production of crops in floodplains.

# SUMMARY

The following tables illustrate the specific needs by subbasin/county for water resource management in the study area as identified in the Type IV study.

Minnesota	
County,	
Brown	
needs,	
of	I
Summary	

	Summary of needs, brown county, minnesona	County, minnesota		
		Big Cottonwood	Little Cottonwood	Milford Town, Hall
Need	General	River	River	watershed (1)
Flood damage reduction and drainage	Need some on-farm drainage, group projects on Milford Town Hall and Mounds Creeks. Other outlets are established.	Minor flooding.	Annual flooding to Flooding problem. intensively cropped but fairly narrow floodplain.	Flooding problem.
Irrigation	Three operators are irrigating 280 acres. The underground water supply is questionable.			
Recreation and fish and wildlife development				Needs recreation. (1
Erosion and sedimenta- tion control			·	
Lake improvement	Sleepy Eye Lake is being dredged. Boise Lake needs improvement.	<b>.</b>		
Water quality	Almost all lakes have algae problems. Water is "hard."			
Water supply	Sections 28 through 35 in Stately Township have a deficiency. Scattered agricultural areas throughout the county have problems. Sleepy Eye and New Jim need more water to attract future industries.			

Minnesota
County,
Cottonwood
needs,
of
Summary

		Area		
		Highwater		Dutch
Need	General	Dry Weather Creek (1) Creek (3)	Mound Creek	Creek (3) Mound Creek Charley Creek (4)
Flood demage	Draftsoo to needed on	Come #10034 no onlineal Medenta	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	Wednesday fleed and
reduction (II)	45 percent of the land.	over into Mound (reek, (1) flood	and and	louerate ilou piou-
and drainage (III)	Group projects are	Drainage improvement problem.	drainage.	needed.
	needed. Multipurpose			
	projects are needed for			
	Mound, Dry Weather, and			
	Dutch tharley treeks. Most floodplains are			
	pasture with the main			
	damage to roads and			
	bridges.			
Irrigation (VIII)				
Recreation (V) and			Recreation	Recreation Potential environ-
fish and wildlife (VI) development			needed.	mental corridor.
Erosion and sedi- mentation control	Streambank erosion on all streams.			
Lake improvement (IV)	Improvement needed on Bean, Double, and Long Lakes.			
Water quality (VII)				•

Drainage laws should be updated. (2)

Water supply (IX)

Other

<sup>\*</sup> Numbers in parentheses denote District Conservationist's priorities. Roman numerals indicate priorities expressed in questionnaires from county commissioners and soil conservation district supervisors.

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		Area
		CNI watershed
Need	General	8-22 8-23 8b-12 8b-07 8b-06 8b-09 (1) 8b-10 8b-11
Flood damage reduction (I) and drainage (II)	Group type (multi- purpose drainage is	Severe flooding and impaired drainage
	needed on all water- sheds with flood problems.	
	On-farm drainage and outlets needed on other lands (eastern portion of county).	
Irrigation (IX)	None presently; questionable cost returns.	
Recreation (V) and fish and wildlife (VI) development	Sections 23 and 30 of Maxwell Township needed for nesting refuge. Proposed wildlife area on Florida Creek.	Max- for posed r1da
Erosion and sedimentation control (IV)	Bank caving on county ditches. Sediment deposition in channels.	°S1
Lake improvement (VII)	Improvements needed on Salt, Peg, and Marsh Lakes and Lac qui Parle.	1. 1.e.

Water is hard throughout

Water quality (III)

Water supply (VIII)

0ther

county.

Evaluation of wetlands acquisition needed.

No problems noted.

<sup>\*</sup> Numbers in parentheses indicate District Conservationist's priorities. Roman numerals indicate priorities of county commissioners and soil conservation district supervisors.

*
Minnesota
County.
Lincoln
f needs,
Summary of

		ביייריבייי סימורץ, יודוווופסטרם "		
		Area		
T and X	Č	Yellow Medi- Norwegian		
naak	veneral	cine River (2) Creek (3) Tyler Creek (4)	ler Creek (4)	Lake Hendricks
Flood damage reduction (II) and drainage (I)	All types of drainage are needed.	Flooding and impaired drainage	inage	Outlet problem.
Irrigation	One irrigator. Lack of dependable water supply.			
Recreation (V) and fish and wildlife (IV) development		Improvement needed	ed edbaba	
Erosion and sedimentation control (III)		Needed		
Lake improvement	Lake Benton and Shoakatan Lake have algae problem and are polluted.			
Water quality	"Hardness" throughout county.			
Water supply	No problem noted.			
Other	Proper land use is needed for area. (1) Wetlands acquisition should be evaluated. (1)	led tould		

\* Numbers in parentheses indicate District Conservationist's priorities. Roman numerals indicate priorities determined by county commissioners and soil conservation district supervisors.

	Summary of needs, Lyon County, Minnesota*	
	V	
	Upper Yellow Three Mile Tyler Redwood	Meadow
Need	General Medicine River(1) Creek(1) River(2) Cre	Creek
Flood damage reduction (I) and drainage (III)	Multipurpose drainage	
Irrigation	None at present. Water source is questionable. Questionable cost returns for field crops.	
Recreation (V) and fish and wildlife (VI) development	Some interest shown	
Erosion and sedimenta- tation control (IV)	Siltation in channels	
Lake improvement (VI)	Cottonwood, School Grove, West Twin, and Goose Lakes need improvement.	
Water quality (II)	"Hardness" throughout county.	
Water supply (VIII)	No problem noted for present use levels.	
Other	Wetlands acquisttion should be evaluated.	

\* Numbers in parentheses indicate District Conservationist's priorities. Roman numerals indicate priorities determined by county commissioners and soil conservation district supervisors.

Summary of needs, Murray County, Minnesota "

		AI ea		
Need	General	Plum Creek		Redwood River
Flood damage reduction Mand drainage	Multipurpose project needed on Redwood River. Remainder of drainage is on-farm.	Mainly drainage ne	eds. (1)	Mainly drainage needs. (1) Drainage versus wildlife land use controversy.
Irrigation N	None in basin. No good water source.			
Recreation and fish and wildlife development		Interested.		Interested.
Erosion and sedimenta- $\mathbb{P}_1$ tion control (II)	Problem is normal for region.			
Lake improvement No	No need listed.			
Water quality (I) No	No problem noted.			
Water supply No	No problem noted.			
Other W	Wetlands acquisition should be evaluated.			

Minnesota	
County,	
Pipestone	
needs,	
mary of	
Sun	

	tr (coan to (loumpe	dummally of metas, typestone county, miniciples	
		Area	
		Headwaters of	
Need	General	Redwood River	Tyler Creek
Flood damage reduction	One multiple-purpose drainage project needed. Remainder is on-farm drainage.	Multiple-purpose drainage project needed. (1)	Both are needed.
Irrigation	None.		
Recreation and fish and wildlife development			Potential fish and wild- life site. (2)
Erosion and sedimenta- tion control		Needed.	Needed.
Lake improvement	No need noted.		

(1), (2) - Priorities assigned by District Conservationist.

Wetlands acquisition should be evaluated.

"Hardness" in this area.

No problem noted.

Water quality Water supply

Other

7	
Minnesota	
County	
Þ	
, Redwoo	
•	
needs	
of	
Summary	

	Summer of Heed	demand of heeds, herwood county, himseld	ritilliesola .		
		Redwood Falls	Ramsey	Minnesota	Sleepy Eye
Need	Genera1	and Redwood River	Creek	River	Creek
Flood damage reduction and drainage	Almost all needed group drainage projects are completed. Some onfarm drainage is needed.	Slight flooding problem.	Slight flooding problem.	Minnesota River floodplain	Slight flood- ing problem.
Irrigation	Six in operation. Questionable cost returns.				
Recreation (III) and fish and wildlife (IV) development		Potential environmental corridors. (1)	mental corri-	Could be developed as environmental corridor.	ı
<pre>Erosion and sedimenta- tion control (I)</pre>			Moderate bank erosion.		Bank erosion.
Lake improvement					
Water quality (II)	"Hard" water throughout county,	Redwood River is polluted. (2)			
Water supply	Sections 16 through 22 of Charlestown Township lack dependable water supplies.	Industrial ex- pansion may be limited.			·

<sup>\*</sup> Numbers in parentheses indicate District Conservationist's priorities. Roman numerals indicate priorities determined by county commissioners and soil conservation district supervisors.

*	
Minnesota	
e County.	
Medicine	
Yellow	
of needs,	
of	
Summary of	

					Area			
		Canby		Lac				Minnesota
		Creek	Lac qui	qui	Yellow			River
		water-	Parle	Parle	Medicine Florida	Lazarus	Mud	Spring valley
Need	Genera1	shed(1)	Creek(2)	River(2)	River(2) Creek(2)	Creek(2)	Creek(2)	Creek(2) (3)
Flood damage reduc-	Need multipurpose	Both are		S	Severe flooding and impaired drainage	impaired	drainage	
drainage (II)	on all seven flood areas and Hanley Falls Creek and	· na pa au						
	St. Leo on the west. On-farm drainage in eastern part of county.	_						
Irrigation (VIII)	None practiced. Questionable cost returns.				•			
Recreation (VI) and fish and wildlife		Needed.						Potential for en-
(IV) development								viron- mental corridors.
Erosion and sedi- mentation control (	(111)	Needed.	 		Channel sedim	sedimentation -		
Lake improvement	Improvement needed at Miedd(3) and Spellman Lakes.	at nan						
Water quality (V)	"Hardness" is a prob- lem throughout the	ļ						
Water supply (VII)	Need water supply in the St. Leo area. (4)	ر <del>ر</del> (4)						
Other	Wetlands acquisition should be evaluated.	1. (5)						

<sup>\*</sup> Numbers in parentheses indicate District Conservationist's priorities. Roman numerals indicate priorities determined by county commissioner and soil conservation district supervisors.

Dakota	
South	
Countles.	
Brookings	
and	
Deuel	
needs,	
of	
Summary	

	Summary of needs, Devel and Brookings Countles, South Dakota	and brookings	Countles, Sou	th Dakota	
			Area		
				Oak Lake and	Fish Lake and
		Cobb-Florida	Yellow Bank	Lake Hendricks,	Lake Cochrane,
Need	General	watershed(1)	River(2)	Brookings County	Deuel County
Flood damage reduction and drainage	Small group type drainage needed along Lac qui Parle River and Mud Creek. Multipurpose drainage projects needed for the Cobb-Florida watershed. Other drainage needed is on-farm.	Need both.	Need both.		
Irrigation	Possible area near Gary.				
Recreation and fish and wildlife development		Possible com- flict with drainage.	·		
Erosion and sedimenta- tion control	Normal needs for area.				
Lake improvement				Needed.	Needed.
Water quality	No major problems in Deuel County.				
Water supply	No problems noted.				
Other	Wetlands acquisition should be evaluated. (3)				

(1), (2), (3) Indicate District Conservationist's priorities.

South Dakota	
South	
Counties,	
i, Grant and Codington Counties,	
and	
Grant	
needs,	
of	
Summary of needs,	

mc .	Summary of needs, crant and conington counties, south Dakora	Area	
Need	General	Mud Creek	Yellow Bank River (1)
Flood damage reduction and drainage	Drainage needed is mostly on farm.	Under construction,	Both flooding and drainage problems; mostly flooding.
Irrigation	None; lack of irrigable soils.		
Recreation and fish and wildlife development			Some interest expressed.
Erosion and sedimenta- tion control	Normal problems along face of Coteau.		Needed.
Lake improvement	No need noted.		
Water quality	"Hardness" throughout area. Streams are becoming polluted.		
Water supply	La Bolt and Albee have no municipal supply. Milbank may have future need.		
Other	Wetlands acquisition should be evaluated. Agassiz Basin Resource Conservation and Development project should be established. (2)		

## EXISTING PROJECTS AND PROGRAMS

## INTRODUCTION

Opportunities for solving identified problems and meeting anticipated needs through Federal, State, and local agencies and programs are presented in this chapter. Although service is available through these agencies, the initial requirement for assistance generally rests with the residents and landowners in the basin. Properly understood and used, these programs represent a valuable resource upon which local units can draw for the solutions of community problems and attainment of community goals. Land treatment measures, such as terraces, waterways, and the establishment of grass or trees, will be accomplished only when the individual landowner is motivated to do so. Other measures, such as floodwater retardation, municipal and industrial water supply, or public recreation facilities or structures, require group or community action. Land treatment measures, when combined with a structural program, provide an integrated watershed management program.

There is also a continuing program to inform landowners of the assistance available from these agencies so that they may select the combination of programs that best meets their needs and desires. The public involvement program will acquaint the public with the objectives of this study.

## FEDERAL AGENCIES

# U.S. Department of Agriculture (USDA)

<u>Public Law 46.</u> - This law established the Soil Conservation Service (SCS) and made it responsible for developing and carrying out a national program of conservation and development of land and water resources.

The SCS has an objective of integrating the planning of land use and installation of conservation treatment in harmony with the capability and needs of the land. To accomplish this, SCS employs scientists and technologists from many disciplines to diagnose land and water resource problems and prescribe successful treatment and use.

Most of the on-the-land SCS assistance to landowners is channeled through local soil and water conservation districts. Some of the conservation practices on which the SCS has offered technical assistance in the basin include:

Conservation cropping systems

Grass waterways

Critical area planting

Minimum tillage

Drainage field ditches

Pasture and cropland

management

Grade stabilization structures

Crop residue use

Tile drains

Terraces

Fish pond management

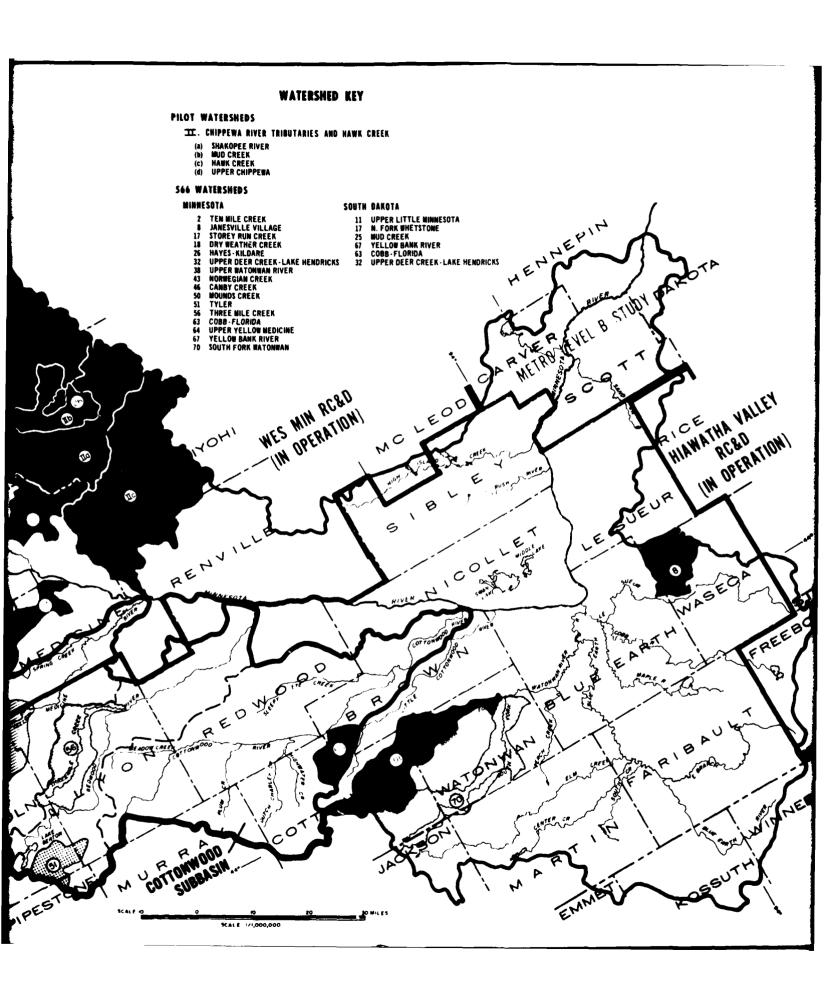
Land grading

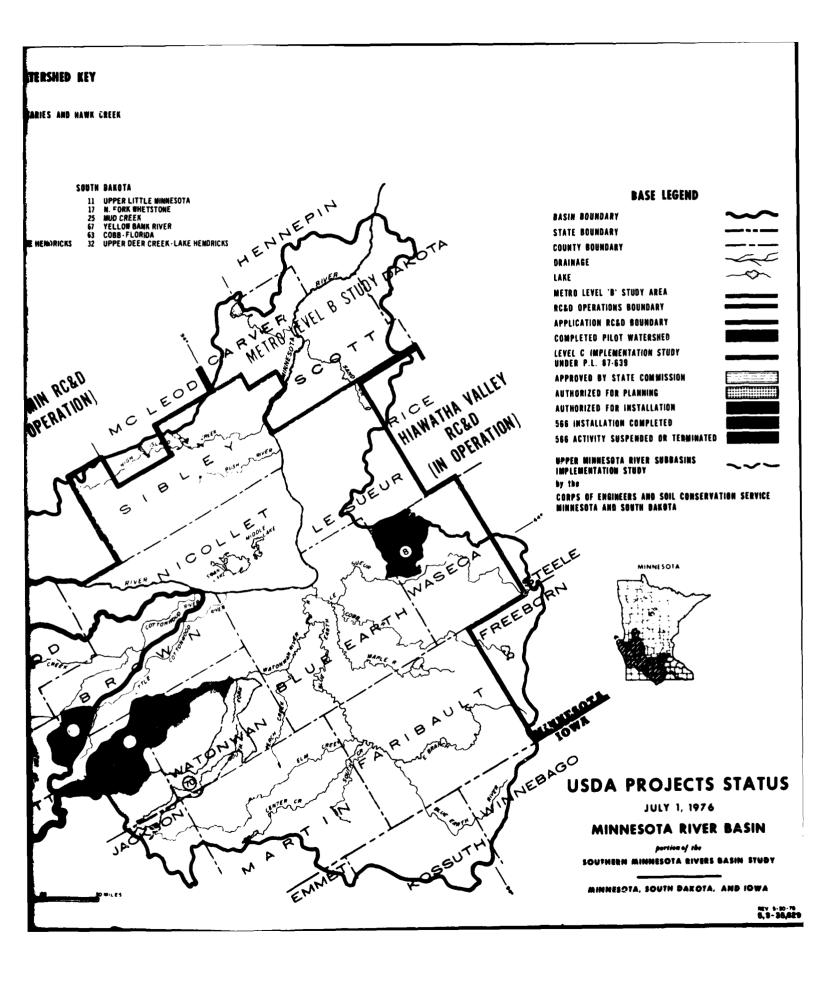
Farm ponds

Animal waste control systems

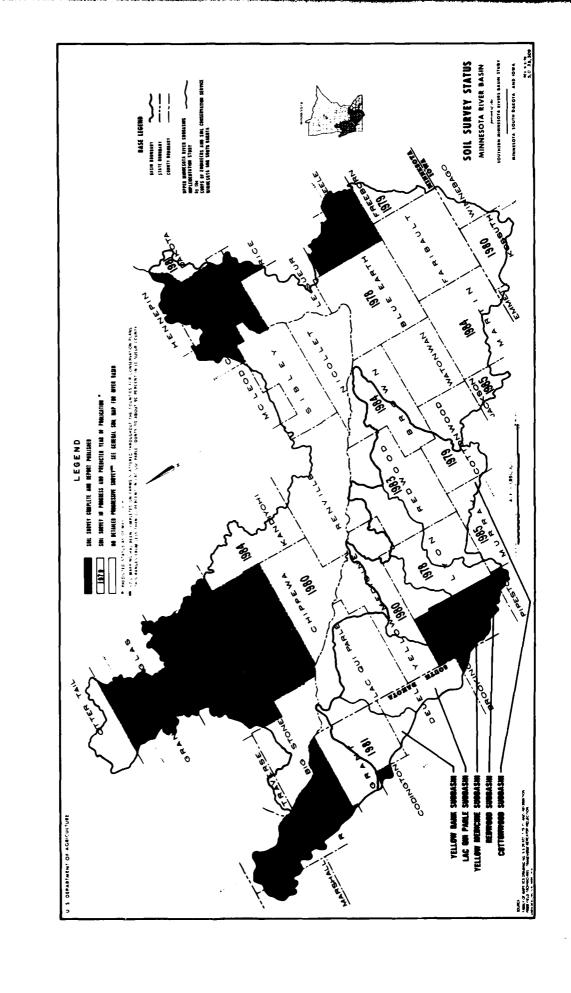
These measures have solved numerous erosion, sediment, and drainage problems in the basin and have resulted in increased agricultural yields and reduction in crop damages. Many areas in the basin still have land and water resource problems, and additional work to apply more conservation practices must be undertaken.

The SCS also administers the Soil Survey Program which surveys the soil resources for the Nation. This program examines soils in the field and in laboratories; describes and classifies; maps kinds of soils; interprets soils according to their adaptability for various crops, grasses, and trees; studies their behavior under use or treatment for plant production or other purposes; and evaluates their productivity under different management systems. See the following figure for the status of this activity.





When available, this information is valuable in the selection of building sites, production of crops, location of recreation development, and many other undertakings where the soils will have a major effect. The following figure shows the status of the soil curvey in the Minnesota River basin.



Public Law 566. - Under this program, technical and financial assistance to State and local organizations is provided for planning, designing, and installing watershed works of improvement. Cost-sharing is provided for flood prevention, irrigation, drainage, sedimentation control, fish and wildlife development, and public recreation. Long-term credit can be obtained by local interests for their share of the cost. This program provides a means of solving watershed protection and flood prevention problems which cannot be adequately met by other ongoing programs. It is administered by the SCS.

Currently, 13 Public Law 566 projects in the basin are at various stages of development. The status of these projects is shown on the USDA Project Status Map on page 93.

The Forest Service is responsible for the forestry phase of Public Law 566 watershed projects and soil and water conservation applicable to land used for forestry purposes.

RC&D (Resource Conservation and Development) projects. - The RC&D program was authorized by the Food and Agriculture Act of 1962. It expands opportunities for conservation districts, local units of government, and individuals to improve their communities in multicounty areas. To carry out the program, financial and technical assistance may be provided to sponsors in carrying out eligible measures having community benefits, such as:

- 1. Critical area treatment (erosion and sediment control).
- 2. Flood prevention using:
  - a. Structures.
  - b. Land stabilization.
- 3. Public water-based recreation developments.
- Public water-based fish and wildlife developments.
- 5. Farm irrigation.
- 6. Land drainage.
- Soil and water management for agricultural related pollutant control.
- 8. Accelerated services.

The study area includes one RC&D project - the WesMin RC&D project. It encompasses all or parts of Yellow Medicine and Lac qui Parle Counties in the northern portion of the study area. An application has been made for the Prairie Lake RC&D project in South Dakota. It will include parts of three counties within the basin. See figure on page 93.

The SCS has leadership in this program. Assistance is provided where acceleration of ongoing programs of resource conservation, development, and utilization will increase economic opportunities for local people.

Clarke-McNary Act. - Professional and financial assistance is provided to States for fire protection on non-Federal forest land. The States administer the protection programs and are reimbursed from Federal funds up to 50 percent of expenditure. Federal participation includes services such as assistance in training personnel, development and procurement of better fire equipment and tools, preparation of fire plans, and direction of the nationwide forest fire protection program.

Cooperative Forest Management Act of 1950. - States are provided financial and technical assistance to assist private forest landowners in practicing multiple-use forest management. The cooperative forest management program is administered by the State and reimbursed from Federal funds on a cost-sharing basis. Private forest landowners are provided on-the-ground technical assistance by professional foresters employed by the State.

States may also receive financial and professional assistance for sawmill operators and other processors of forest products for improved logging, processing and manufacturing techniques; marketing information; and safety.

<u>Farmers Home Administration</u>. - This Department of Agriculture agency administers many programs available to landowners and rural communities. Among the services are:

- 1. Emergency leans.
- 2. Farm ownership loans.
- 3. Financial assistance to small towns and rural groups.
- 4. Loans and grants for farm labor housing.
- 5. Loans for forestry purposes.
- 6. Loans for recreation purposes.
- 7. Loans to rural families with low incomes.
- 8. Operating loans.
- 9. Rental loans.
- 10. Rural housing loans.
- 11. Rural renewal loans.

Of particular importance in the basin are farm ownership loans, financial assistance to small towns and rural groups, and loans for recreational purposes. Farm ownership loans are used for a variety of purposes, including providing basic soil treatment and land conservation measures as well as providing necessary water and water facilities. Also of significance is the program which provides financial assistance to small towns and rural groups and makes loans and grants to public and nonprofit organizations which primarily serve rural areas to plan and develop domestic water supply and waste disposal systems. Loans are provided to operators or managers of family farms to develop land and water resources; repair and construct buildings; purchase land, equipment, and related recreational items; and pay necessary operating expenses.

These programs can assist financially in solving major sediment and erosion problems, as well as providing municipal water, waste disposal systems, and recreational facilities. ASCS (Agricultural Stabilization and Conservation Service. - The ASCS administers several Department of Agriculture programs. One of these, the ACP (Agriculture Conservation Program) provides cost-sharing assistance to agricultural producers who undertake soil, water, forestry, and wildlife conservation practices on farmlands currently in agricultural production. The cost of such practices is shared between the Federal Government and the agricultural producer.

Technical assistance for ACP practices is rendered by the SCS and the Extension Service. This program can serve as a valuable tool in solving the erosion and sedimen\* problems and meeting the other resource needs in the basin through the establishment of conservation practices.

Public Law 87-639. - This law authorizes the Secretary of the Army and the Secretary of Agriculture to make joint investigations and surveys of watershed areas for flood prevention or the conservation, development, use, and disposal of water. Reports are made jointly on such surveys and investigations and submitted jointly to the Congress for approval. Funds are appropriated, as necessary, to carry out the purpose of this act. This study has been authorized under Public Law 87-639 for the study area.

Extension Service. - The Extension Service's basic job is to help people identify and solve their farm, home, and community problems through the use of research findings of the Department of Agriculture, the University of Minnesota, and programs administered by the Department of Agriculture. The Extension Service is very active in the basin in helping local people solve many of their resource problems through its educational programs.

## U.S. Army Corps of Engineers

Flood Control Act of 1936. - This act and a resolution approved 10 May 1962 authorized a Minnesota River basin survey with a view toward determining the advisability of further improvements in the basin for

navigation, flood control, recreation, low-flow augmentation, and other related purposes. Continued study and interagency coordination is maintained. The study is scheduled for completion in 1981.

Flood Control Act of 1960. - A local flood protection project on the Redwood River at Marshall, completed in December 1963, included channel improvement, a diversion channel, two drop structures, four new railroad bridges, and five new highway bridges across the diversion channel (see the following photographs). A current study to extend protection upstream of the diversion channel, control crossover flood flows to the Cottonwood River basin, and increase the overall protection provided by the existing project is scheduled for completion in June 1978.



Looking upstream at the diversion channel on the Redwood River at Marshall, Minnesota



Looking downstream at the diversion channel on the Redwood River at Marshall, Minnesota

Flood Control Act of 1948. - A local flood protection project on the Yellow Medicine River at Minnesota, Minnesota, completed in May 1963, included a levee, channel improvement, a creek diversion ditch, culverts, sewer outfall, sandbag closures, and a new highway bridge constructed by local interests.

Floodplain Information Report. - A floodplain information report was prepared for Marshall, Minnesota, in 1974-75. The report provides reliable flood information needed to implement floodplain management practices required by Minnesota's Flood Plain Management Act.

## Heritage Conservation and Recreation Service

This agency has responsibility for providing outdoor recreation areas and facilities on areas designated as State parks, State preserves, and natural lakes. It reviews all outdoor recreation plans prepared for county conservation boards and municipalities for participation in the land and water conservation fund program. It also reviews projects submitted by agencies for Federal funding assistance and is responsible for reviewing cultural resources investigations and determining which cultural resources are to be included on the National Registers of Historic Places and Natural Landmarks.

## National Weather Service

The National Weather Service is responsible for issuing flood warnings and advisory forecasts. There are 13 locations that issue forecasts based on observed precipitation and stages at upstream points and anticipated weather conditions. The forecasts are distributed to the media for public information.

# U.S. Department of Housing and Urban Development, Federal Insurance Administration

This agency investigates flood hazards at locations specified by the State to aid in administration of the Flood Insurance Ict of 1978 and the Flood Disaster Protection Act of 1973.

## Environmental Protection Agency

This agency is responsible for study and development of quality standards for classification of Minnesota waters.

# U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service is responsible under law for the preservation, management, and enhancement of the Nation's fish and wildlife resources. The management of migratory birds and nationally endangered species is a primary Federal responsibility; the management of resident fish and wildlife is a principal State responsibility. To carry out the goal of preservation and enhancement of the Nation's fish and wildlife resources, the Fish and Wildlife Service works toward minimizing adverse impacts on these resources as a result of local, State, and Federal land and water resource development programs.

#### STATE AGENCIES

## Department of Natural Resources

This department is assigned the responsibility of conserving and promoting the wise use and management of the natural resources of the State.

## Principal responsibilities are to:

- 1. Provide management assistance to private owners of forest land.
- 2. Acquire, develop, and maintain State parks, recreation areas, cance and boat routes, wild and scenic rivers, trail systems, and wildlife management areas.
- 3. Protect and manage the State's wildlife and fisheries resources to assure sustained yields and research to uncover new management methods and an ample supply of game and nongame wildlife and fish for Minnesotans.
- 4. Provide administrative leadership and guidance to the locally organized soil and water conservation districts.
- 5. Manage State-owned forest land.
- 6. Carry out State-local cooperative programs for management of floodplain and shoreland areas.
- 7. Administer the use, allocation, and control of public waters.

#### Minnesota Pollution Control Agency

This agency has the responsibility for adopting standards and regulating the discharge of pollutants into the water, air, and land resources of the State.

#### Southern Minnesota Rivers Basin Board

The board has responsibilities as described on page 1.

# Water Resources Board

The board has the jurisdiction, power, and authority to establish watershed districts and to define and fix their boundaries. A watershed district may be established upon filing of a nomination petition.

# Soil and Water Conservation Board

This Board provides assistance to soil and water conservation districts. The Board administers the new \$3 million cost-sharing program through the Soil and Water Conservation Districts for permanent practices to control soil erosion. The Board also administers the State construction program which consists of financial assistance to counties, watershed districts, and Soil and Water Conservation Districts for project and construction costs of floodwater retarding and retention structures. The Minnesota Legislature appropriated \$250,000 in fiscal year 1976-77 and about \$540,000 in fiscal year 1978-79.

## Minnesota Geological Survey

The Geological Survey is responsible for conducting geologic investigations in Minnesota. An essential part of its responsibility is to provide the geologic data needed to evaluate the State's groundwater resources. The survey was established by an act of the State Legislature and is administered under the Board of Regents of the University of Minnesota.

## State Water Planning Board

This board has responsibility for coordinating State agency involvement in water resource planning and development.

#### LOCAL GOVERNMENT AGENCIES

## Soil and Water Conservation Districts

These districts are legally constituted units of State government created to administer soil and water conservation work within their boundaries. They sponsor or cosponsor most watershed protection and flood prevention and resource conservation and development projects. By virtue of their broad activities, districts have an important role in the development of rural areas.

The districts focus attention on land and water problems, develop annual and long-range programs designed to solve problems, and enlist all the appropriate, available help from public and private sources that will contribute to the accomplishment of the districts' goals.

# Watershed Districts

Watershed districts are legally constituted units of State government created to administer water resources improvements within their boundaries. They cosponsor watershed protection and flood prevention and resource conservation and development projects. They have powers of taxation and eminent domain and oversee the maintenance and care of existing water resources projects.

#### IMPROVEMENTS DESIRED

#### INTRODUCTION

Many meetings have been held by various Federal and State agencies and local interest groups throughout the basin to discuss the water and related resource problems in the area. The needs and desires of interested people have been expressed at these meetings. A considerable amount of time, effort, and concern has already been expended to achieve

at least a partial solution to the area's problems. However, as evidenced by the continued problems throughout the basin, it is necessary to develop a fully coordinated overall water and related resource plan to satisfy the existing and projected needs of the basin. The area II Action Committee, in conjunction with the Watershed Districts, Soil and Water Conservation Districts and County Boards, is currently involved in the study and will establish the eventual priority for implementation of measures to solve the most severe problems in the study area.

#### LOCAL SPONSORS

Needs identified by the local people and the policy committee (Type IV study) Which represents local citizens are grouped into five general priority categories:

- 1. Flood damage reduction.
- 2. Improved drainage on agricultural lands.
- 3. Erosion control.
- 4. Pollution abatement.
- 5. Recreation and fish and wildlife improvements and developments.

In recent years, consideration for the environment has become a major objective in resource planning. Because of this concern for the environment by a variety of citizens and groups, planners must explore available alternatives that not only have economic benefits, but environmental benefits as well.

Other concerns relate to changing public demands and emphasis which are shifting toward programs that will provide for a quality environment in which to live and grow. In developing new public programs, planners and legislators should consider these shifts in values.

Although new programs are needed in several areas, details of these programs are not worked out. The following concerned areas can be mentioned:

- Programs should be developed that will provide for greater cost-sharing to individual landowners for the installation of conservation practices that improve resources providing public benefits. Special emphasis should be given to water quality improvement. Existing programs could be modified to provide for increased cost-sharing.
- 2. The Resource Conservation and Development program should be expanded to cover more of the basin.
- 3. Programs are needed that give more attention to the environmental corridor concept and other nonstructural measures for solving resource problems. Public acquisition of areas that are unique and provide environmental benefits should be seriously considered.
- 4. Private land has a great potential for meeting fishing, hunting, and other recreational demands. Programs that provide incentives to open these areas to the public are needed.
- 5. The Minnesota Legislature created Chapter 83, Laws of 1976, which authorizes various procedures that modify the public waters and drainage laws of Minnesota. Of specific interest is the authorization of a county-by-county inventory of water basins and watercourses by the Department of Natural Resources and counties, respectively, and the creation of a State water bank program identifying eligible wetlands and specifying rights and obligations of the Commissioner of Natural Resources and the landowner.

During the interim year between introduction of the bill and its passage into law, 19 counties in the Minnesota River basin participated on a pilot basis, with the DNR, on classifying the public waters of their respective counties. To complete the watercourse inventory, each county requested help from its local SCS District Conservationist. The time spent on

the inventory was paid for by the Type IV Minnesota River Basin Study funds. The result of the effort enabled those 19 counties to test the details of the proposed law, gain cooperation with the Department of Natural Resources and offered them the opportunity to establish a county-State management inventory of the public waters in each county.

Because the bill has been signed into law, the rest of the counties in the State can begin inventory and classification procedures. The results will be county maps showing all the areas needing water permits, extended management authority over the waters in each county, and compensation for certain areas that are classified as public waters. The final step in establishing public waters is a joint State-county public hearing.

## REGIONAL AND STATE AGENCIES

The Southern Minnesota Rivers Basin Board has expressed desire for the following improvements:

- Accelerate the application of land treatment measures to cropland, pastureland, streambank, woodland, and urban construction sites under provisions of Public Law 46.
- Expand technical and financial assistance to help solve flooding, drainage, sediment, and erosion problems within the study area under provisions of Public Law 83-566 (such as at current construction sites in the Canby Creek Watershed).
- 3. Expand technical and financial assistance to help install eligible project measures to improve economic conditions of local residents within Resource Conservation and Development areas under provisions of Public Law 87-703. Examples of this assistance are installation of grade control structures, carp barriers, recreational improvements, and accelerated land treatment.

- 4. Provide an assortment of loans to individuals and groups for resource conservation and environmental improvements. Needed technical information relating to soil and water conservation programs and recreation needs is available through Federal Extension Service specialists.
- 5. Convert cropland to forest land where excessive erosion or other problems dictate change of use under provision of the cooperative State-Federal forestry programs. Also, select and implement recreational areas through use of environmental corridors and open-space areas.
- 6. Solve the flooding problems in the study area by installing 81 floodwater retarding structures and 10 miles of crossover levees identified in the Type IV study report under provision of Public Law 87-639.
- 7. Use soil survey information to determine land capability and best use through land treatment investigations and policy formulation for land use and taxing.

#### Other interested agencies have expressed the following needs:

- 1. The completion of soil surveys.
- 2. State cost-sharing with individuals for conservation measures.
- 3. Emphasis on the environmental corridor concept in development.
- 4. Expansion of the incentive program to open land for recreation.
- Upstream runoff control using natural wetlands or small impoundments.
- 6. Minimizing effects of increased drainage in degrading water quality.
- 7. Comprehensive State plan for conservation of soil and water resources.
- 8. Education in soil and water conservation practices.
- 9. State land use policies and coordination between State policy and local action policy.

- 10. Basin-wide monitoring for water data.
- 11. Coordination of soil conservation legislation with 208 planning for control of nonpoint source pollution.
- 12. Additional information about the relationship of transportation to the overall economy and movement of goods.
- 13. Corrective programs to decrease roadside erosion.

#### SIGNIFICANT OPPOSITION

To date, there has been no significant opposition to the desired improvements.

## PLANNING PROCESS AND PROCEDURES

#### **GENERAL**

Formulation is used to develop a plan or plans which will provide the best uses or combination of uses of water and related land resources to meet the identified needs of the study area. However, as already noted, the problems of the many subbasins and the main stem of the Minnesota River are varied and extensive and some have been identified in previous studies. Detailed implementation solutions to all of the problems cannot be accomplished in an initial overall report. Resources, problems, and alternative plans for the overall solutions will be developed and followed by detailed implementation plans for particular subbasins or other suitable subgroupings.

The following specific planning considerations will be used in the formulation process:

- a. Reduction of floodwater and sediment damage.
- b. Improvement of drainage on agricultural lands.
- c. Decreased erosion from proper land treatment and management.
- d. Water quality management.
- e. Recreation improvements.
- f. Fish and wildlife habitat enhancement.

The basin-wide comprehensive water and related land resource plan was developed based on problems and needs identified by local, regional, and State organizations and local people. The Southern Minnesota Rivers Basin Commission coordinated the input and based the plan selection on alternative proposals developed by the U.S. Department of Agriculture.

The following sections establish general guidelines for conducting the multiobjective planning process in level C feasibility investigations. The guidelines are consistent with the planning requirements of the Water Resources Council Principles and Standards and related planning policies and regulations. The Principles and Standards require that Federal and federally assisted water and related land planning consider NED (national economic development) and EQ (environmental quality) as equal objectives. Four specific activities will be undertaken during the formulation process: problem identification, formulation of alternatives, impact assessment, and evaluation.

#### PROBLEM IDENTIFICATION

In problem identification, the range of water and related land resource problems each study will address is determined. Planning objectives are established to give direction to subsequent planning tasks. Resource management problems and public concerns are identified and analyzed to determine the physical area to be studied; existing and projected resource conditions in the area are surveyed; and this information is synthesized into specific planning objectives. Activities to be carried out in problem identification are shown in the following table.

Activity	identification activities Summary
Determine public concerns	Identify:  1. Resource management issues.  2. Population growth.  3. Economic development.  4. Significant environmental (physical and cultural) concerns.  5. Others (structural vs. managerial measures, etc.)
Analyze resource management problems	Determine relationship between public concerns and different resource manage ment activities.  No constraints on study with preestablished resource development outputs.
Define study area	Base definition on study authority and public concerns, resource problems, hydrologic boundaries, etc.
Describe base condition	Use available local, regional, and statewide data; land use plans and projections; etc.  Develop information on:  1. The resource base (economic, social, natural, archeological, historical, etc.).  2. The resiliency, sensitivity, and importance of ecological, cultural, and aesthetic elements of the study area.  3. Existing and authorized resource management systems.  4. Institutional base study.
Project future conditions	Determine range of alternative futures.  Consider publics' views and compromise conflicts among them.  Use OBERS (Office of Business, Economic Research Service) data (if not, so discuss).  Assess sensitivity of all projections using a supply/demand analysis as a minimum.  Establish "without" conditions.
Establish planning objectives	Determine conditions or actions needed to accomplish desired futures.  Screen objectives.  Identify objectives derived from issues, constraints, and problems.  Determine timing and location (when and where) of objectives.  Resolve conflicts or make trade-offs among objectives.

## FORMULATION OF ALTERNATIVES

Alternatives to solve each of the problems described will be identified, evaluated, and screened in Stage II, Development of Intermediate Plans. Those alternatives remaining after the screening process will be interfaced in Stage III, Development of Final Plans, to develop a number of comprehensive implementable solutions. The selected plan will be developed from these solutions.

Types of alternatives developed in the Type IV U.S. Department of Agriculture study and their possible beneficial and adverse impacts are shown in the following tables. A map showing 206 reservoir sites evaluated in the Type IV study is on page 118. The map indicates only the physical potential for storage in the basin. More intensive investigation will be made to verify topographic and geologic data before any sites are considered for detailed planning.

Results of first iteration of preliminary plans of improvement - Type IV study

	NESULIS OF 11181 1 LETALING OF PRESENTING OF AMPLICACHER - 19PE 10 STUDY	in to supply the	provenent - 1ype 1v study
Alternative	Impact	Evaluation	Remarks
206 two-stage control	Decreased urban flood damages downstream	Beneficial	Alternative for downstream flood protection
reservoir sites on tribu-	of reservoir site		was determined economically infeasible in pre-
taries to main, stem of	Decreased agricultural flood damages	Beneficial	liminary studies. Review of potential benefits
major rivers. (1)	downstream of reservoir site		occurring because of reduced rural and urban
	Reduced flood insurance costs	Beneficial	flood damages shows small benefits relative to
	Increased land use	Beneficial	reservoir costs. Detailed studies of upstream
	Loss in wooded wetlands	Adverse	flood damage may use some upstream site locations
	Increased fish and wildlife habitat	Beneficial	for protection or as alternative sites for the
	at reservoir site		81 selected sites found feasible.
	Permanent evacuation of personnel and	Adverse	
	property from reservoir area		
	Increased water surface area (natural environment component)	Beneficial	
206 peak discharge reduc-	Decreased urban flood damages down-	Beneficial	This alternative would only provide protection
ing reservoirs located	stream of reservoir site		downstream of reservoir site. Alternative would
upstream of the coteau	Displacement of people and property	Adverse	be approved by many area residents. Preliminary
escarpment (1)	from reservoir site		studies indicated that the project would be
	Investment, operation, and maintenance	Adverse	marginal; however, recreation and fish and wildlife henefits were not considered. Additional informa-
	Leaveston London subject actions of the Co	D	the de mandard to determine fronthists Doors
	scent water body provided (matural environmental component)	pener iciai	cion is required to determine reability. Asser-
	Increased figh and wildlife habitat area	Reneficial	Sites were small, beak discharge reducing
	Taundorton of mooded areas	Adverse	floodwater retarding structures. General down-
	Inungation of wooded areas	Reneficial	
	Increased Land use of downstream	Deliet Torgi	Stream damage reduction was approximately
	floodplain		IO percent; would not meet sponsor's desired
	Improved water quality	Beneficial	degree of protection.
	Decreased sediment deposition in channel	Beneficial	
	Tool of measured and for the land	4 4.000	
	LOSS OF RESERVOIR BREES TOF OTHER LAND.	Adverse	
	Increased recreational opportunities	Beneficial	
	Increased water surface area (natural	Beneficial	
	environmental component)		
81 reservoirs located on	Decreased urban flood damages below	Beneficial	Alternatives with reservoirs and levees to con-
coteau and watershed	reservoir site		fine floods were determined to be the most eco-
crossover levees'''	Decreased agricultural flood damages	Beneficial	nomically feasible. However, recreation and
	below reservoir site		Tigh and Wildlie Deneilts Were not considered
	investment, operation, and maintenance Costs	Adverse	in penetic evaluation. Additional intolmetion is required to determine project feasibility.
	Increased fish and wildlife habitat	Beneficial	Upstream reservoirs in conjunction with cross-
			over levees will be considered in detailed
			studies.

Results of first iteration of preliminary plans of improvement - Type IV study (cont)

247,000,000	Impact	Evaluation	Remarks
81 reservoirs located on coteau and watershed crossover levees(1) (cont)	Inundation of wooded areas Increased use of downstream floodplain	Adverse Beneficial	
	improved water quality Decreased sediment deposition in channel downstream of reservoir site Loss of reservoir area for other land use purposes	benericiai Beneficiai Adverse	
	Increased recreation opportunities Increased water surface area (natural environmental component)	Beneficial Beneficial	
81 reservoirs and levees (10 miles) located on rivers with 2- and 10-year channel designs:		Beneficial Adverse	Alternatives with selected reservoirs and levees and varying degrees of channel improvement were determined to be favorable in preliminary studies; however, recreation and fish and wildlife bene-
		Adverse	fits were not considered in benefit evaluation. Additional information is required to determine
	Decreased sediment deposition on downstream areas	Beneficial	channel frequencies. Upstream reservoirs and levees in comjunction with channel improvement
	Loss of wooded wetland areas Temporary degradation of water quality during channel improvement	Adverse Adverse	will be considered in detailed studies.
	>	Beneficial	
Crossover levees alone	Increased recreational opportunities Loss of cropland used for levees	Beneficial Adverse	Alternatives were determined economically in- feasible in preliminary studies.
	Induced peak discharge downstream Reduced flow outside the watershed	Adverse Beneficial	In most areas, induced peak discharges down- stream would have considerable impact on downstream areas. Not considered a viable alternative by itself.

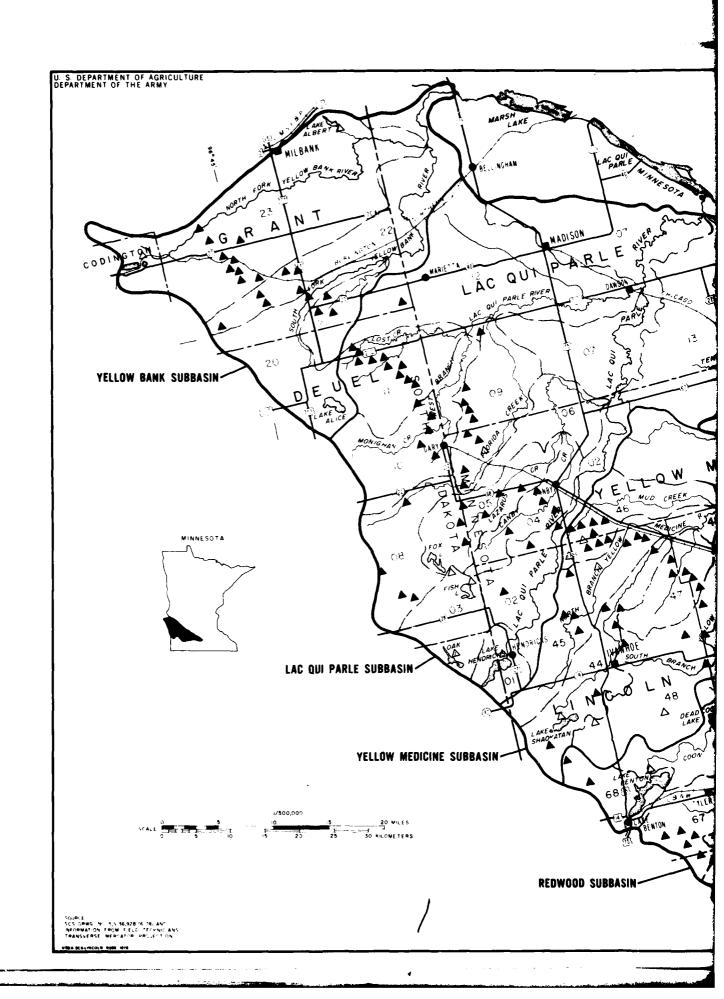
Results of first iteration of preliminary plans of improvement - Type IV study (cont)

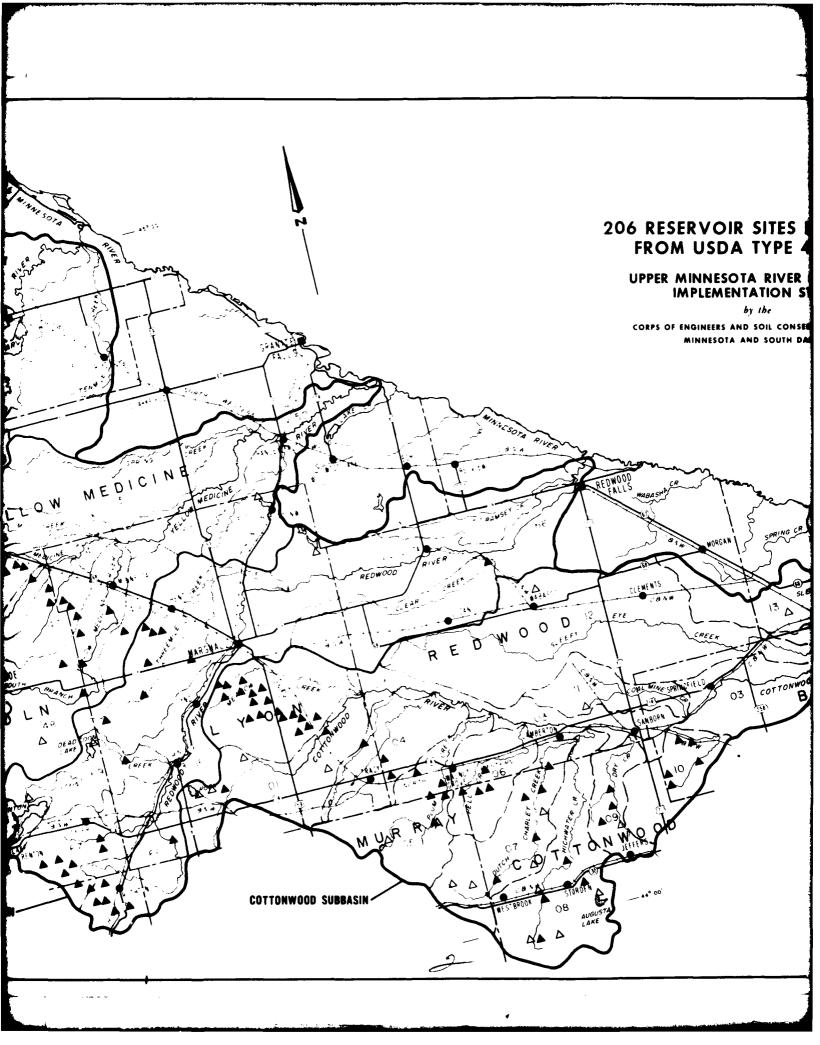
•	Alternative	Impact	Evaluation	Remarks
•	Channel cleanout	Decreased agricultural flood damages Investment and maintenance costs Temporary degradation of water quality Loss of wooded wetlands Loss of fish and wildlife habitat	Beneficial Adverse Adverse Adverse Adverse	Preliminary studies determined alternative was marginal. Additional information required. Will be considered in detailed studies (change in flow characteristics).
_	Channel enlargement (includes 5-year and 3-year channel designs)	Decreased urban flood damages Decreased agricultural flood damages Investment and maintenance costs Loss of wooded wetland Increased land use Reduced flood insurance costs Temporary degradation of water quality Loss of fish and wildlife habitat areas	Beneficial Beneficial Adverse Adverse Beneficial Beneficial Adverse	Not considered a feasible alternative by itself. Preliminary studies indicate that channel enlargement is economically feasible in some waterways. Channel enlargement would provide adequate outlet for SCS projects. Channel enlargement will be considered in detailed studies; 100-year channel enlargement will be considered in urban areas only. Lesser degrees of protection will be considered in agricultural areas but only after floodwater retarding structural program and crossover levees (alternative 3)
116	Leveed floodways (alone) (includes 10-year and 100-year leveed floodway designs)	Decreased urban flood damages Decreased agricultural flood damages Investment and maintenance cost Loss of wooded wetland Increased land use Loss of fish and wildlife habitat Temporary degradation of water quality	Beneficial Beneficial Adverse Adverse Beneficial Adverse Adverse	Preliminary studies indicate alternative not economically feasible in agricultural areas. However, detailed determinations of location benefits and inundation reduction benefits were not made. Leveed floodways were evaluated without measures to evacuate interior floodwaters. Additional information required. Detailed studies will consider leveed floodways with attendant gated outlets. Loop levees with gated outlet and/or pumping stations around small urban centers will also be considered. Levees will be considered in agricultural areas where cross-over flooding occurs.

Results of first iteration of preliminary plans of improvement - Type IV study (cont)

Alternative	Impact	Evaluation	Remarks
Flood proofing	Decrease in flood damages to	Beneficial	Will be carried through to next iteration.
	selected structures Investment and maintenance cost	Advorse	Limited data preclude any reliable estimate of wishilty or areas with notantial for
		Adverse	flood proofing.
	flood damages		- G
	Decreased or eliminated flood insurance costs	Beneficial	
	Minimal impact on natural environment	Beneficial	
Floodplain evacuation	Disruption of agricultural life styles and affendant mental annuals	Adverse	Not economically feasible in rural or urban
	Major investment costs	Adverse	detailed studies in concert with structural
	Decrease in flood damage	Beneficial	measures to provide greenway belts and flood
	Change to less intensive use of	Adverse	buffer zones.
	דפונס דנפססדנע		
No action	Continued flood damage	Adverse	Alternative will be carried throughout the
	Underuse of land resource	Adverse	planning process.
	Periodic evacuation of population	Adverse	
	segment		
	Continued flood insurance costs	Adverse	
	No investment costs	Beneficial	
	No disruption of aquatic habitat	Beneficial	
	Increased wildlife area as land use	Beneficial	
	becomes less intensive in flooding		
	4074		

<sup>(1)</sup> See the map on page 118.



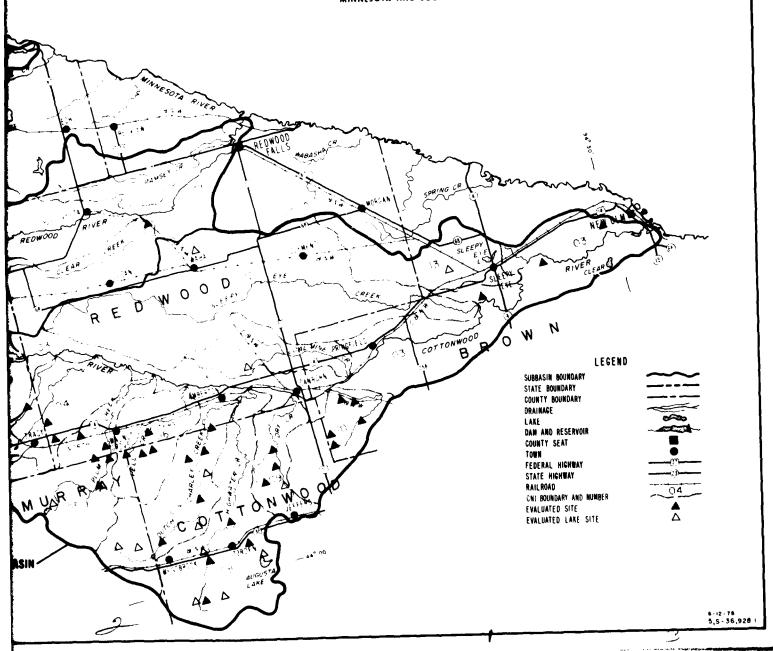


# 206 RESERVOIR SITES EVALUATED FROM USDA TYPE 4 STUDY

UPPER MINNESOTA RIVER SUBBASINS IMPLEMENTATION STUDY

by the

CORPS OF ENGINEERS AND SOIL CONSERVATION SERVICE MINNESOTA AND SOUTH DAKOTA



The plans which are initially formulated will be assessed and evaluated. Plans which best address NED, EQ, and a mix of the two will be identified. Candidates for NED plans are those which are likely to maximize net economic benefits; candidates for EQ plans are those that make the most significant contributions to preserving, maintaining, restoring, or enhancing cultural and natural resources. During subsequent iterations, candidate plans will be reformulated to insure that the best NED, EQ, and mix plans are included in the final array of alternatives. Designation and reformulation of candidate plans require substantial professional analysis and judgment and should reflect public preferences and desires. If appropriate, the plans should meet the 1983 water quality goals of Public Law 92-500 which represent the minimum environmental standards consistent with national policy. The NED and EQ plans are not intended to establish a polar condition. Because a plan that optimizes NED and one that emphasizes EQ must still meet a range of specific evaluation criteria, they could be similar or even the same plan. Where NED and EQ plans are significantly different, other alternatives reflecting significant trade-offs between them will be formulated so as not to overlook the best overall plan. An essentially "nonstructural plan" and a "no development plan" will be carried through the planning process. Activities to be carried out in formulation of alternatives are shown in the following table.

Summary of plan	formulation activities
Activity	Summary
Identify management measures	Consider technical vs. institutional means and constraints.  Nonstructural means should be considered equally.
Categorize applicable non- structural and structural measures	Examine conflicts among measures and complementariness of measures. Examine contributions to many objectives versus one objective. Prepare statement of findings.
Develop plans	Synthesize measures into plans. Select measures and determine how well they meet the identified objectives. Identify conflicts and those objectives not met. Analyze remaining objectives as a basis for identifying structural measures that address a number of objectives. Add structural measures that address single objectives to complete the system. Develop the NED and EQ plans. Consider possible no development alternatives: a. Maintain current land use. b. Maintain bridge capacities and road network.
Consider plans of others	Consider plans of Federal, State, and local governments and private organizations.

# IMPACT ASSESSMENT

Impact assessment is the identification, description, and, if possible, measurement of the effects of the different alternative plans on the base year condition. Consistent with the requirements of the Principles and Standards, Section 102(2)(c) of the National Environmental Policy Act, Council on Environmental Quality Guidelines and Section 122 of the River and Harbor Act of 1970, impact assessment

provides for analyzing the significant effects of each alternative. These effects are the economic, social, historical, archeological, or environmental consequences of an alternative that would likely have a material bearing on the decision-making process. Impact assessment requires forecasting where and when significant primary and higher order effects could result from implementing a given alternative. This determination requires analyzing and displaying monetary and nonmonetary changes in an objective manner based on professional and technical assessment of the resources. The absence of change or no net change from the base condition could also be a significant impact in certain instances and care must be taken to develop such information during this task. Describing impacts does not reflect societal preferences; these preferences are determined through subsequent evaluation. Activities to be carried out in impact assessment are shown in the following table.

Activity	Summary
Identify source of impacts	Categorize whether impact is by the measure itself, its inputs (natural resources, energy, labor, etc.), or its outputs (plan products).
Identify and trace impacts	Perform cause-effect analysis.
Determine incidence of impacts.	<ol> <li>Identify:         <ol> <li>Location - study area, OBERS area(s), and/or the Nation.</li> <li>Timing - prior to, during, or after plan implementation or in long-term future.</li> <li>Duration - short- or long-term.</li> </ol> </li> <li>Reversibility.</li> </ol>
Measure impacts	Determine changes from the base condition.

#### **EVALUATION**

Evaluation is the analysis of each plan's impacts compared with the "without condition" and other plans. Whereas impacts are identified through an objective undertaking largely on professional analysis, evaluation determines the subjective value of these changes. This determination is accomplished by conducting "with" and "without" analyses of the alternative plans. The process begins by establishing the contributions of each alternative to the planning objectives and the NED, EQ, regional development, and social well-being accounts of the Principles and Standards. The response of the alternatives to specified evaluation criteria will be determined. From this information, judgments will be made concerning the beneficial and adverse nature of the contributions of an alternative to establish its overall desirability. The first three activities listed below provide more explicit information on performing this aspect of evaluation. The relative merits of each remaining alternative in comparison with the other remaining alternatives will then be established. By so doing, evaluation will reveal information which will be incorporated in succeeding iterations to achieve more fully beneficial contributions while reducing adverse contributions. Activities to be carried out in evaluation are shown in the following table.

		tv	

#### Summary

#### Categorize impacts

Compare impacts with planning objectives to identify any relationships. Identify actual or potential beneficial or adverse contributions:

- Actual will occur under the auspices of a governmental agency or the normal working of the economic system.
- Potential requires action by a different agency or entity.

Determine contributions to national accounts:

- 1. Identify and note uncertainties.
- 2. Note who or what gains or loses.
- Identify location, time, and duration.
- Identify unintended contributions, reformulate if significantly adverse.

# Identify NED and EQ plans

# System of accounts.

Determine national interest

- Total economic and environmental benefits of plans.
- 2. Total economic and environmental costs of plans.
- 3. Compare benefits and costs.

# Apply other specified evaluation criteria

Acceptability by affected publics. Certainty that planning objectives are met.

Completeness - whether all actions needed for full attainment have been incorporated.

Effectiveness - technical performance and contribution to objectives.

Efficiency - least cost performance.

Fquity - fair distribution of advantages and disadvantages by family income classes. Benefit-cost ratio.

Planning space - relevancy of geographic area encompassed by plan.

Reversibility - is return to base condition possible if unusual future conditions so warrant?

Stability - what range of alternative futures can be accommodated?

Summary of eva	aluation activities (cont)
Activity	Summary
Perform trade-off analysis	Compare monetary and nonmonetary units, data, and qualitative information.  Trade-offs must reflect public preferences, State and national interests and constraints.
Specify basis for next iteration	Base on trade-off analysis. Increase beneficial and reduce adverse contributions. Maximize actual contributions and reduce uncertainty. Identify mitigation measures for unavoidable adverse impacts. Consider mitigation based on Federal initiative.

#### REPORT DEVELOPMENT

GENE PAL

The interim feasibility investigations and the overall basin study will be conducted in three stages.

#### STAGE I - DEVELOPMENT OF A PLAN OF STUDY

During this stage, principal emphasis will be on the identification of resource management problems and concerns in the study area. Because of the introductory nature of the planning process in this stage, the effort will generally involve analyzing a wide range of available data that may be more qualitative than quantitative. The general purpose of this stage is to make an initial analysis of water and related land resource management problems and how they may be solved. The product will be plan of study (POS) document describing the scope of the interim study and the broad management actions necessary to carry it out.

#### STAGE II - PREPARATION OF A PRELIMINARY FEASIBILITY REPORT

The preliminary feasibility investigation will be an assessment of water and related land resource problems, needs, concerns, and potential solutions identified in the plan of study. The preliminary feasibility report will formulate an array of alternative plans, identify impacts, and determine the advisability of proceeding with more detailed studies. The report will be based on review and evaluation of available data and limited field and office studies. All studies and data requirements for more detailed investigations will be identified during this stage. Problems and needs to be investigated in a preliminary manner during this stage of study include flooding, inadequate drainage of cropland, erosion and sedimentaion, and water quality. The investigation will consider beneficial and adverse impacts of alternatives on recreation, fish and wildlife, and other environmental features peculiar to the subbasins.

#### STAGE III - FEASIBILITY REPORT

The feasibility report will analyze differences among alternatives and the corresponding effects of trade-offs between the national economic development and environmental quality objectives. Major study efforts will involve collection and evaluation of required data, a system of accounts display, and formulation of the optimum scale of development.

If feasible solutions for problems of the subbasins as well as the overall basin are identified in the preliminary feasibility studies, the feasibility report will specifically identify the measures which appear to best solve the problems. Recommendations will be made in the report that these measures be included as part of the selected subbasin plan. The draft teasibility report and draft environmental impact statement will be coordinated with agencies and other publics. Authorization, advance planning, and funding by Congress are necessary before any of the measures recommended in the feasibility report can be developed.

## INSTITUTIONAL ANALYSIS

An institutional analysis identifies institutions directly or indirectly related to water resources planning and management. Their potential role in the planning process or capability to implement alternatives is assessed.

Many Federal, State, and local agencies and other groups were contacted during the Type IV study by the SCS. The specific roles and responsibilities of each of these agencies were not clearly defined, nor is it certain that all parties affected by the study were identified. An institutional analysis to resolve this uncertainty and better define institutional coordination will be undertaken during stage II of this study. The agencies and groups listed in the following table participated in collection and assembly of data for the Type IV report.

Agencies or groups p	articipating in data collection, Type IV study
Level	Agency or group
Federal	U.S. Department of Agriculture Soil Conservation Service Economic Research Service Agricultural Extension Service Forest Service Farmers Home Administration Agricultural Stabilization and Conservation Service U.S. Department of the Interior Heritage Conservation and Recreation Service Fish and Wildlife Service
State	Geological Survey  U.S. Department of Defense Corps of Engineers  Minnesota Water Planning Board  Departments of Natural Resources - South Dakota, Iowa, and Minnesota  Minnesota Pollution Control Agency Minnesota Department of Economic Development  Minnesota State Planning Agency Minnesota Historical Society  Minnesota Soil and Water Conservation Board
Local	Soil and Water Conservation Districts University of Minnesota County government officials Local residents and citizens committee Water Resources Board

The Corps of Engineers and Fish and Wildlife Service have a coordination agreement which applies to this study. Regional representatives of the Fish and Wildlife Service have been asked to participate in the study and furnish data and assistance as appropriate during the study. The service's planning aid letter concerning fish and wildlife resources in the study area is in appendix B. During Stages II and III, the Fish and Wildlife Service will:

- Analyze study alternatives and proposals affecting fish and wildlife resources.
- 2. Determine the probable effects of potential projects on fish and wildlife resources and associated habitats.
- 3. Recommend measures to prevent or reduce damages to and improve conditions for fish and wildlife.
- 4. Participate in public meetings and workshops.

#### STUDY MANAGEMENT

#### INTRODUCT ION

Management procedures have been defined which will serve as a guide for conducting the study. The Department of Agriculture and Corps of Engineers will coordinate all planning activities under the direction of the Minnesota State Conservationist (Soil Conservation Service) and the District Engineer (St. Paul District, U.S. Army Corps of Engineers). Day-to-day responsibility for the study rests with the Staff Leader, River Basin and Watershed Planning Section (Soil Conservation Service, U.S. Department of Agriculture) and the Chief, General Investigations Section, Planning Branch (St. Paul District).

#### DIVISION OF STUDY RESPONSIBILITY

Study management was defined during preparation of the plan of study. The investigation is managed by cochairpersons from the SCS and Corps. Work groups composed of technical representatives from both agencies and other Federal and State agencies handle the technical study efforts. The following table illustrates how work group leadership and support functions are divided between the SCS and Corps.

Division of study responsibility

Work group	Lead agency	Support agency
Public Involvement	SCS/Corps	-
Planning and Study Management <sup>(1)</sup>	SCS/Corps	_
Hydrology and Hydraulics	SCS	Corps
Engineering <sup>(2)</sup>	Corps	SCS
Erosion and Sedimentation	SCS	Corps
Economics	SCS	Corps
Environmental <sup>(3)</sup>	scs	Corps
Water Quality	Corps	SCS

<sup>(1)</sup> Includes the study cochairpersons and all other work group chairpersons.

The study cochairpersons, in consultation with discipline supervisors from the lead agencies, assigned these leadership and support responsibilities. The assignments were reviewed by the study advisory committee. Previous study area involvement (for example, SCS hydrology work for the Type IV study) and recognized scope of expertise (for example, Corps large dam design and dam safety program) helped determine the initial assignment of responsibility. Some modifications to the division of responsibility could be made as a result of funding levels, directives from higher authorities, or changes in study objectives agreed to by all study participants.

#### SOUTHERN MINNESOTA RIVERS BASIN BOARD (SMRBB)

The purpose and intent of this board as stated in Minnesota Statutes, Chapter 114A, are as follows:

<sup>(2)</sup> Includes geology and foundations investigations, embankment-levee design, other design, real estate, and cost estimates.

<sup>(3)</sup> Includes biological resources, cultural resources, recreation resources, and social analysis subgroups.

"114A.03 Purpose and Intent. Subdivision 1. The southern Minnesota rivers basin board is hereby established to serve as the regional organization for guiding the creation and implementation of a comprehensive environmental conservation and development plan for the basin. All state departments and agencies are hereby directed to cooperate with the board, and to assist it in the performance of its duties. In cooperation with all federal agencies, including but not limited to the United States departments of agriculture and interior and the corps of engineers, all state agencies, departments, and commissions, including but not limited to the department of natural resources, Minnesota geological survey, water resources board, state planning agency, department of transportation, soil and water conservation board, pollution control agency, department of economic development, department of agriculture and the institute of agriculture of the University of Minnesota, and local governments and citizens within the basin, the board shall initiate, coordinate and prepare its overall comprehensive environmental conservation and development plan. The Minnesota soil and water conservation board and local soil and water conservation districts and watershed districts within the basin shall provide technical assistance to the board in the creation and implementation of the plan. Upon the request of the board, the governor or the legislature may require any other department or agency of the state to furnish assistance, technical or otherwise, to the board in the performance of its duties or in the exercise of its powers authorized by law. The plan may include, but is not limited to, planning for the following purposes:

- (1) Control or alleviation of damages by flood waters;
- (2) Improvement of stream channels for handling of surface waters, navigation, and any other public purposes;
  - (3) Reclaiming or filling of wet and overflowed lands;

- (4) Regulating the flow of streams and conserving the waters thereof;
  - (5) Diverting or changing watercourses in whole or in part;
- (6) Providing and maintaining water quality and supply for municipal, domestic, industrial, recreational, agricultural, aesthetic, wildlife, fishery, or other public use;
- (7) Providing for sanitation and public health and regulating uses of streams, ditches, or watercourses for the purpose of disposing of waste and maintaining water quality;
- (8) Repair, improvement, relocation, modification, consolidation, or abandonment in whole or in part of previously established public drainage systems within the territory;
- (9) Imposition of prevention or remedial measures for the control or alleviation of land and soil erosion and siltation of watercourses, or bodies of water affected thereby;
- (10) Regulation of improvements and land development by abutting landowners of the beds, banks, and shores of lakes, streams, watercourses and marshes by permit or otherwise in order to preserve the same for beneficial use; such regulation to be in accordance with state department of natural resource standards and criteria;
- (11) Regulation of construction of improvements on and prevention of encroachments in the flood plains of the rivers, and the lakes, marshes and streams of the basin; such regulation to be in accordance with state department of natural resources standards and criteria.
- Subd. 2. Implementation of plan. Upon reviewing and approving the overall comprehensive environmental conservation and development plan for the basin, the board shall be the coordinating agency for the implementation of the plan and it may designate and request any local unit of government, including but not limited to counties, cities, soil and

water conservation districts and watershed districts, to initiate, implement and carry out any phase, project or improvement provided for in the board's plan. The board may engage in public education programs."

The Southern Minnesota Rivers Basin Board will continue to work toward implementation of flood control measures in the study area according to recommendations in the Type IV study. It established an advisory committee with the following policy-level representation:

Mr. Arnold Onstad, Chairperson, Southern Minnesota Rivers Basin Board

Mr. George Bekeris, Area Manager, Fish and Wildlife Service Colonel Forrest T. Gay, III, District Engineer, St. Paul District, Corps of Engineers

Mr. Tom Kalitowski, Chairperson, Minnesota Water Planning Board

Mr. Harry Major, Scate Conservationist, SCS

Mr. Willard Pearson, Chairperson, Area II Action Committee

#### ADVISORY COMMITTEE

The advisory committee facilitates communication and transfer of information to the agencies and persons interested in the study. It insures that various concerns of the study are given an open forum for expression and establishes work groups comprising technical representatives from Federal and State agencies, assesses work products, and provides support or redirection.

The committee is an innovative approach that assures that interested agencies and groups will be continuously informed during planning. In this way, they can guide the process.

#### CITIZENS ADVISORY COMMITTEES

Two citizens committees have been formed. The Policy Committee was established by the Southern Minnesota Rivers Basin Board to provide local input and guidance for investigations in the study area. It has broad membership in the area.

The Action Committee, recently incorporated as the Area II Minnesota River Basin Projects Incorporated, has five voting members — one from each subbasin in the study area. This committee is a citizens advisory committee for a 10-county area with emphasis on implementation of recommendations of the Type IV study. South Dakota has one nonvoting member. Efforts are being made to upgrade this to full voting representation.

#### COORDINATION AND STUDY MONITORING

The principal study coordinator and monitor is the advisory committee. This function is performed through interaction with SCS and the Corps as investigators, the Southern Minnesota Rivers Basin Board as overall coordinator of the Minnesota River basin studies, and the Area II Action Committee as the principal local group at the present time in the public involvement program. This function will expand as the study progresses. The need for detailed information on economic, environmental, and social impacts of alternative plans will continue to include more local individuals and interest groups in the planning process. Letters documenting interagency coordination, interest, and concerns are included in appendix A.

#### PUBLIC INVOLVEMENT PROGRAM

#### **GENERAL**

Although the Soil Conservation Service and Corps of Engineers share responsibility for the study, close liaison will be maintained with Federal, State, and local agencies and local interests to insure development of a complete and factual study.

#### **OBJECTIVES**

Public participation in study planning provides timely information and assurance that alternatives will, to the extent possible, be responsive to public needs and preferences. The Federal participants will evaluate the engineering aspects and weigh the environmental, economic, and social impacts of the alternatives. The public will participate in establishing criteria to screen values among alternatives. Elected officials retain the major decision-making authority in the trade-off analysis in the selection of a plan.

#### IDENTIFICATION OF PUBLICS

The publics are individuals, agencies, and other groups that may be decision-makers or those to whom the people look for guidance in the solving of problems. These representatives balance the needs and preferences of constituents and other technical and political groups which influence plan selection.

#### AGENCY AND GROUP RESPONSIBILITIES

A public involvement program helps to bring out all issues concerning a particular study and insures that these issues are given full consideration. To a large extent, this purpose can be accomplished by directing public involvement efforts to a limited, organized segment of the public - interest groups, relevant government agencies and officials at all levels, key citizens (sometimes referred to community influentials), and individual citizens who would experience significant impacts from any of the alternatives considered. Initially, this group is likely to be small, because only a limited number of people are interested in relatively general discussions of planning objectives, problems, and potential solutions. As alternatives become better defined and their impacts known, more people will become interested because they can see how they will be affected. The key is to identify these groups and individuals early in the study so that they can be involved from the start.

One of the best means for providing public involvement is through a citizens participation committee composed of a uniform cross section of individuals from the study area representing civic and conservation groups; residential, business, commercial, and other interests from the urban community; agricultural interests; members of the academic community; members of professional groups; and representatives of the various political subdivisions involved (cities, townships, and counties). A manageable committee would be composed of about 10 to 15 members.

The Corps of Engineers, SCS, and other interested Federal and State interests would serve as technical advisors to the committee. Involvement of the SCS field staff (area and district conservationists) will be extremely important.

The functions of the committee are to:

- Provide valuable assistance in keeping the public fully informed about study status and progress.
- Solicit from all concerned interests their opinions and views regarding possible solutions.
- 3. Provide a definite contribution in assessing impacts on the existing resources, evaluating all alternatives and selecting the best plan.
- Hold meetings open to the public and disseminate pertinent information discussed at the meetings through the news media.
- 5. Adopt a position paper summarizing its activities and covering any proposals they agree should be taken into account in the decision-making and subsequent planning phases.

This committee could be formed by the Southern Minnesota Rivers
Basin Board. The Area II Policy Committee served in a similar manner during
the Type IV Study. The committee functions as explained above would be
advisory but also decision-making in being a forum for expression of
both proponent and opponent concerns of area interest groups, weighing
the concerns and other facts, and recommending action to best meet the
needs of the publics.

To complement the public involvement centered at the local level will be a defined institutional arrangement for decision-making and advice from the regional, State, and Federal level to the Governors of Minnesota and South Dakota. The regional level could be represented by the Southern Minnesota Rivers Basin Board and the East South Dakota Conservancy District. The coordination assignment at all levels would be specific in distinguishing between decision-makers in public involvement and the ongoing technical input from the State, regional, and Federal agencies during the study.

#### **MEETINGS**

The citizens participation committee meetings are open to the public. The meeting formats may be workshop oriented particularly when requesting views on criteria for forming and screening alternatives. The committee will host and arrange for meetings as needed to keep represented bodies and groups informed on study alternatives and status and to give input to the study; for example, suggestions on additional alternatives for the study. Sufficient notice of the meetings will give all interest groups the opportunity to be a part of the planning process.

Specific meetings will be scheduled to correspond with the need to review study products as described below.

- 1. A meeting will be held to review the plan of study and establish criteria to make value judgments among alternatives.
- 2. At the completion of preliminary feasibility studies when alternative solutions are known but before a plan has been tentatively selected, a midstudy public meeting will be held. Major purposes of this meeting are to present the results of preliminary studies including the advantages and disadvantages of the various alternatives to the extent that such information has been developed and to further develop public views and desires, particularly as they relate to the various alternatives.
- 3. A late stage public meeting will be held after detailed studies and before report completion. Findings of the detailed studies, including the rationale for any proposed solution, and the tentative recommendations will be presented. This meeting will insure that any plan presented would be acceptable.

The approximate calendar schedule for the public meetings is shown on the sequence diagram (see page 174). Notices for the public meetings will be distributed to interested Federal, State, regional, and local agencies, institutions and groups about 1 month before each meeting.

#### **ACTIVITIES**

The initial coordination meeting for the joint study effort took place in July 1975 at St. Paul. The meeting was attended by representatives from the SCS, Minnesota Department of Natural Resources, Area II Action Committee, and Corps of Engineers. Representatives from the congressional delegations also attended the meeting. Discussion centered on the complex flooding problems in the study area and resulted in a recommendation by the participants to request authorization for a joint SCS-Corps implementation study under Public Law 87-639. The study was authorized by the Committee on Public Works and Transportation of the House of Representatives in December 1975.

Following the initial meeting and the subsequent study authorization, a number of coordination meetings were held during 1976 and 1977. The SCS and Corps were funded to begin the study in October 1977 (fiscal year 1978).

The Southern Minnesota Rivers Basin Board recognized that the study and any subsequent implementation would be successful if the Federal, State, and local agencies and the concerned citizens cooperated and agreed on the course of the study. For this reason, the board formed an advisory committee for the study with the following membership:

Area II Action Committee, Minnesota Water Planning Board, SCS, Corps, and Fish and Wildlife Service. It will be chaired by the Southern

Minnesota Rivers Basin Board. The first meeting of the advisory committee was held on 9 December 1977. The second meeting of the advisory committee was held 7 April 1978. The preliminary draft plan of study was presented and distributed for review and comment.

A bus tour of the study area was conducted by local sponsors on 25 through 27 April 1978. Representatives of local, State, and Federal agencies from Minnesota and South Dakota were invited.

A joint SCS-Corps meeting with the South Dakota Natural Resources Subcabinet took place on 3 May 1978 at Pierre, South Dakota. An orientation presentation was made by the study cochairperson. A presentation on the study was made to a joint Minnesota-South Dakota SCS Area Conservationist's meeting 23 May 1978.

Soil Conservation Service Washington office and Technical Service Center personnel m : with study participants to review overall study direction and the preliminary draft plan of study on 30 May-2 June 1978. A joint meeting was held with personnel from the Corps St. Paul and North Central Division offices on 1 June 1978.

The third meeting of the advisory committee was held on 9 June 1978. Comments received on the preliminary draft plan of study were reviewed.

The advisory committee conducted a public orientation meeting at the Ramada Inn at Marshall on 26 July 1978. A second tour of the study area sponsored by the advisory committee and assisted by local sponsors was conducted on 27 July 1978.

This draft plan of study will be coordinated with local, State, and Federal agencies during October 1978.

# DETAILED STUDIES, WORK SCHEDULE AND COST

#### STUDIES REQUIRED

#### General

Water and related land resource problems, needs, and potential solutions have been identified in this plan of study. Various types of studies will be undertaken to assure continual accuracy and completeness of investigations. The total study effort is divided into eight major work groups - public involvement; planning and study management; hydrology and hydraulics; engineering; erosion and sedimentation; economics; environmental; and water quality. A description of work to be done and a listing of the major work items, time sequence, products, and personnel requirements are shown for each work group.

# Plan Selection and Formulation

A final water and land resources management plan will be selected and the optimum scale of project development will be formulated based on four factors: national economic efficiency, environmental quality, regional development, and social well-being. The factors are referenced in Federal Register, Volume 38, No. 174, Part III, 10 September 1973, which gave notice of Principles and Standards for planning water and related land resources effective 25 October 1973.

# Planning and Study Management

Planning studies will assess the flood and related water and land resource problems of the study area. Alternative solutions will be investigated for solving these problems. Current formulation criteria and policies will be used to evaluate the development of alternative plans

incorporating both nonstructural and structural measures as appropriate. Analysis of alternatives and impacts of trade-offs among national economic development, environmental quality, and social well-being will be assessed in selection of the best solution. The major study effort will be to select a final plan that best meets overall area resource needs and formulate the optimum scale of project development. As an integral part of the planning effort, coordination will be maintained with the interested publics throughout all stages of the study. Report preparation and development will be a specific responsibility of this work group. The study will be conducted in accordance with all applicable legislation, rules and regulations, guidelines, and executive orders for land and water resource planning.

Study management will involve managing the overall study effort to insure the conduct and timely completion of the study. The following are management tasks:

- 1. Monitor study progress to insure adherence to the schedule.
- Program funds needed to accomplish the study and monitor the spending of funds.
- 3. Make arrangements for administrative support.
- Select and negotiate with consultants for technical assistance to be accomplished under contract.
- 5. Coordinate with other Federal, State, and local offices.
- 6. Review all study products to insure their quality and conformance with criteria and guidance set forth by regulations.
- 7. Prepare correspondence and routine documents.
- 8. Prepare interim and final reports and appendixes.

The following table presents a schedule of planning and study management tasks.

Planning and study management schedule
Man-days by agency and discipline

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			Start- Comple-	Comple		Study co- r	Plan- ning	Plan- ning			Report	Study co-	Assist- ant	Assist- ant Engineer-		
go de	Work item	Responsible	fng e jeb	t 100	Product	chair, engi- Drafts- Writer-	engi- D	Tafts-	Writer- editor Tunier		process- chair- coordi-	chair-	coordi-	ing aid draftemen Tendat Total	Tonda	į
	State 1: Plan of Stude			100	1100011	1000	1		101100	18.57		her sort	101	diai remen		101
2	Coordination meeting be-		7.5		Secondarion by											
ì			,		participants to											
	attended by representa-				request toint											
	tives from the SCS.				SCS-Corps Imple-											
	Corps, State of Minne-				mentation Study											
	sots, and congressional				•											
	delegations.															
201	Study authorization by Congress	gress	Dec 75													
202	Begin study	SCS/Corps	Oct 77													
203	Orientation sessions for		;	;												
	planning participants		Nov // May /8	2 2 2 2												
204	Establish Study Advisory Committee	SCS/Corps	Sep 77	Dec 77	Sep 77 Dec 77 Initial meeting of committee											
202	Preliminary identifica- tion of problems and generalized alternatives	Minnesota	Oct 77 Jul 78	Jul 78												
206,	Establish study cri- teria, procedures, and outline for plan of study	SCS/Corps	Oct 77	May 78	Oct 77 May 78 Preliminary draft plan of study	55	91	01	10	10	10	55	40	<b>.</b>	•	210
207	Tour of study area by local, State, and Federal agencies	SCS/Corps	Apr 78	Apr 78	Apr 78 Apr 78 Orientation											
208	Public meeting and tour of study area sponsored by Study Advisory Committee	2	Jul 78	Jul 78	Jul 78 Jul 78 Public involvement						, •	, <b>•</b>				
509	Raview and coordination of draft plan of study	SCS/Corps	Jun 78	յսյ 78	Jun 78 Jul 78 Draft plan of study	Þ										
210	Submit plam of study to higher authorities	SCS/Corps	Sep 78	Sep 78	Sep 78 Sep 78 Draft plan of study	19 55		10	Ω	91	10	55	20	<b>S</b>	<b>v</b>	81
, 12 12	Stage II: Development of Preliminary Alternatives Fallitems studies and SCS/Corps Oct 78 War 79 Display of problems favomitories of work groups	elisinary Ali SCS/Corps	Oct 78	Mar 79	Display of problem	\$						35	01			8
212	Conduct local public participation workshop to werify problems and needs and identify criteria for accening alternatives		Apr 79	Apr 79	Apr 79 Apr 79 Public involvement and valid set of problems and needs	<b>8</b>		50	<b>~</b>	10		9	<b>~</b>	10	ទ្ធ	192
213	Alternate components of alternatives under:  1. Present conditions (no action plan) 2. Future without project conditions 3. Nometructural project auch as environmental corridors and/or changed land use 4. With structural proj- ect such as reservoirs, levees, filodways, and/ or channel modifications	8	Oct 78 Aug 79	Aug 79		110	165					86	3.50			920

Planning and study management schedule (Cont)

						60.	5	51.				3	CALCALLE CONSENTATION SELVICE	7 100	200
							i				3	1			
					Study	Flan-				41000	Study	ABSIST	Producer	,	
	Responsible	le ing tion			chatr-	eng 1-	-		: ايا	•		•			
3	Stage II: Development of Preliminary	Alternatives (co	ı	Product	Person		9	110	editor lypist	Ing	person	n netor	drafteman lypist Total	177	TOT TO
214	Preluminary plan formulation 0ct 79 Mar 80 1. NED components 2. EQ components 3. Mixed NED/EQ components 4. Display alternatives including costs and impacts	Oct 79 Mar 80			110	83	'n	M	v		96	83	Ś	10	700
215	Preliminary evaluation of alternatives 1. Impacts on planning objectives 2. Apply specific evaluation criteria such as acceptability, completeness, effectiveness and efficiency 3. Draft systems of accounts	Apr 80 Sep 80			92	69	<b>v</b>	m	'n		8	6 9	v	10	338
216	Plan formulation public meeting	Nov 80 Nov 80			18	14					16	14			ç
217	Preliminary report and environ- mental assessment submitted to higher authority	Oct 80 Dec 80			36	27	20	20	20	50	32	23	10	10	111
218	Review and coordinate preliminary report and environmental assessment	Jan 81 Jan 81			18	14					16	14			62
219	Checkpoint conference with higher authority and approval of memo for record	Feb 81 Feb 81			18	14					16	14			62
220	Stage III: Development of Detailed A Final definition of problems and needs	Alternatives Mar 81 Mar 81			18	14				*	16	14			62
221	Final formulation of alternatives	Apr 81 Sep 81			110	83	2	3	5		96	83	2	22	007
222	Trade-off analysis of alternatives and final system of accounts	Oct 81 Nov 81			36	27					32	27			122
223	Designate NED and EQ plans	Dec 81 Jan 82			36	17	4		4		32	23	4	æ	145
224	Identify selected plan	Feb 82 May 82			72	*					79	ž			244
225	Draft report and EIS submission to higher authorities	Jun 82 Sep 82			72	27	70	70	20		79	¥	10	07	324
226	Checkpoint conference with higher authority and approval of memo for record	Oct 82 Oct 82			18	14					16	14			62
227	Coordinate draft report and EIS	Nov 82 Dec 82			36	27	4		4		32	27	7	∞	145
228	Public meeting	Jan 83 Jan 83			18	13					16	14			61
229	Final report and revised draft EIS submitted to higher authorities	Jan 83 Apr 83			72	¥ (	s	ន្ទ	01	į	79	<b>3</b>	۰ ۱	2	284
	Total				1,110	763	-	6	101	07	800	1	3	6	081 7

## Hydrology and Hydraulics

Hydrology and hydraulic studies will be performed to further define the problems and needs in the subbasins. Studies of the existing problems and needs will involve a quantitative analysis of:

- 1. Area flooded for a range of flood frequencies.
- 2. Roads and bridges subject to flood damage.
- 3. Areas subject to streambank erosion and floodplain scour.
- 4. Flow characteristics of streams including peak flows by frequency, water yield, and flow duration data.

Hydrology and hydraulic studies will also provide primary data for the formulation of structural and nonstructural alternatives and evaluation of their impacts. These studies will include:

- 1. An inventory of potential reservoir sites including the proportioning of dam embankments and spillways that are found to be physically feasible.
- 2. An inventory of stream reaches where channel capacity is limited and channel improvement and/or levees may be feasible including the preliminary hydraulic design of possible channel modifications and/or levees in these reaches.
- An analysis of the water yield and flow characteristics of streams to evaluate the potential for recreation and fish and wildlife enhancement at potential reservoir sites.
- 4. A display of the extent of nonstructural alternatives such as environmental corridors and/or other changed land use plans.
- An evaluation of the physical impact of alternatives on area flooded, roads and bridges, floodplain scour areas, and the flow characteristics of streams.

Specific hydrologic and hydraulic studies to assist in defining the problems in the subbasins and provide data for plan formulation and the analysis of plan impacts are listed below. The product resulting from these studies and an indication of the magnitude of each study is also included.

- 1. A study to delineate area flooded for any given frequency of flood in the major damage areas including crossover flow areas. Delineation will be made for existing conditions for structural and nonstructural alternatives. The delineations will be made initially on 500-foot per inch topographic maps with the capability of display at other scales and on photomosaics. Floodplain delineation will encompass an area of 450-550 square miles.
- 2. A study to determine the elevation-discharge-area flooded and discharge-frequency in each major damage reach for existing conditions and for alternatives. Studies will include determination of the frequency at which damages begin in each reach. Elevation-discharge-area flooded values will be provided in tabular form for 250-300 reaches. Water surface profile drawings will be made for selected flood frequencies.
- 3. The hydrologic and hydraulic design of structural works including dam spillways and outlet works, channel and levee works, and all appurtenant structures such as culverts, bridges, and grade mobilization structures. Operation plans will be developed for dams with gated spillways. Hydraulic designs will be performed for 70-90 dams, 200-300 miles of channel work, 10-30-miles of levees, and numerous appurtenant structures.
- 4. A determination of channel and floodplain velocities including a display of reaches that may be subject to streambank erosion and floodplain scour.
- 5. A determination of water yield and flow characteristics of streams. Statistical analyses will be made for 20-25 stream gages. Water budget studies will be performed to evaluate water-based recreation potential in 10-20 reservoirs.

Following is a description of the methods to be used in carrying out the studies. A hydrologic computer model will be developed using established modeling techniques of the Corps and SCS. The model will be capable of developing synthesized runoff hydrographs and combining and routing hydrographs through the reservoirs and stream reaches of the subbasins, including the capability of dividing hydrographs at locations of crossover flow between watersheds and subbasins. The model will be capable of predicting discharge-frequency at any desired point in the subbasins for present conditions and for any alternative. The model

will be tested and verified by comparing derived hydrographs with observed hydrographs at existing recording stream gages in the watershed and by comparing derived peak discharges with statistical analysis of all stream gage data in the region. The statistical analyses will be carried out according to U.S. Water Resources Council Bulletin 17A, "Guidelines for Determining Flood Flow Frequency."

The Corps HEC-1, HEC-5, and SSARR and SCS TR-20 hydrologic models will be considered for use. The five subbasin area of 4,353 square miles will be divided into 800-1,000 subwatersheds to develop hydrographs and flood routing.

A water surface profile computer model will be developed for the five rivers and all tributary reaches expected to benefit from alternatives. The profiles will be developed for a range of flood frequencies for existing and alternative conditions. Existing condition profiles will be calibrated from available historical flood high-water marks and profiles. The profile model will establish:

- 1. Elevation-discharge-end area values for use in flood routing.
- 2. Elevation-discharge-area flooded values for use in the tabulation and delineation of flooded area.
- 3. Channel and floodplain velocities for use in flood routing and for determining reaches subject to streambank erosion and areas of floodplain scour.
- 4. Existing bank-full capacities for use in establishing structure release rates and reservoir operation.
- 5. Tail water elevations for design of structure outlet works.
- 6. Channel dimensions and levee heights for alternatives.

The Corps HEC-2 or the SCS WSP-2 water surface profile model will be used. The water surface profile model will involve an estimated 1,200-1,400 miles of floodplain, 6,000-7,000 valley cross sections, and 800-1,000 bridges and culverts. Valley cross-section coordinates will be developed by scaling from 200-foot per inch topographic maps with a basic contour interval of 4 feet and 2-foot interpolated contours and spot elevations in flat areas. Channel cross sections and bridge and culvert data will be obtained by field surveys.

The hydrologic and hydraulic design of floodwater retarding structures will be accomplished using the SCS DAMS-2 computer program and applicable Corps programs. All designs will meet the appropriate safety standards according to the hazard classification of the structure.

The design discharge for channels, levees, and appurtenances will be based on the hydrologic model. Hydraulic design will be accomplished using the water surface profile computer program.

The following table presents a schedule of hydrology and hydraulics studies.

Schadula	~*	hwdrol oev	444	hwdraulics	atudies

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								Engi-		Serv	ice	
ode	Work items		Responsible discipline	Start- ing date	Com- pletion date	Product	Hydraulic engineer		Hydrolo- gist	Hydraulic engineer	Engineer- ing tech- nician	Total
_												
	Stage II: Inventory Existin  Evaluate Potential Flood D		and wasda									
le	Review existing data, final- ize procedures, establish survey and topographic mapping needs		Hydrology/ Hydraulics	Oct 78	Dec 78	Final detailed plan of study for Hydrology and Hydraulics Work Group	20		10	30		61
1	Prepare and execute con- tract for channel and oridge surveys	SCS/Corpe	Hydraulics	Oct 78	May 80	Completed Surveys	60	20		30		11
14	Prepare and execute con- tract for topographic maps of floodplains	SCS	Hydrology	o t 78	Hay 80	Topographic maps with 4-foot contours, 2-foot interpola- tions, and spot elevations in flat areas on 1 inch = 200 feet pencil manuscripts				30	30	6
. 3	Prepare working maps for jetermining watershed boundaries, determine watershed size, damage reaches, etc., for hydrologic model	scs	Hydrology	Oct 78	Jan 79	Four sets of 7 1/2-minute U.S. Geological Survey maps				5	30	3
)4	Determine runoff curve numbers or loss rates	SCS/Corps	Hydrology	Dec 78	May 79	Tabulation® and maps			20	15	25	6
15	Determine times of con- centration and reach routing coefficients in upland watersheds	SCS/Corps	Hydrology	Dec 78	May 79	Tabulations			60	70		13
•	hetablish runoff versus frequency versus drainage area, make VDP studies and rainfall-runoff analysis	SCS/Corp.	Hydrology	May 79	Jul 79	Tabulations and graphs			40	40		8
, .	Establish and run water surface profile model for range of discharges, establish rating curves for crossover flow points, establish routing coeffi- cients for major floodplain	·	Hydraulics	Jan 79	Apr 80	Tabulation# and computer print-out	200	400		400	400	1,40
08	Run hydrologic model, cali- hrate and finalize model	SCS/Corps	Hydrology	May 79	Apr 80	Schematic drawing of rout- ing order and computer print-out with range of discharge versus frequency		50	150	80		21
)9	Run water surface profiles for a range of flood fre- quencies, check results	SCS/Corps	Hydrology	Apr 80	Jun 80	Schematic layout of WSP's and computer print-out of elevation versus discharge versus area flooded	40			80		12
:	Prepare area flooded and flow frequency data for determination of area flooded by frequency	SCS/Corps	Hydrology	Apr 80	Jul 80	Tabulations of discharge versus frequency and eleva- tion versus discharge versus area flooded	20		20	60		10
11	Delineate existing condi- tion area flooded versus frequency for visual display	sos	Hydrology	Jul 80	Oct 80	Delineate area flooded on 1 inch = 500 feet topographi maps	.c			10	80	•
12	Entablish elevation versus discharge data for roads and bridges (input to determine bridge damage); preliminary (not refined with frequency)	SCS/Corp3	Hydrologv	Jan 79	Jun 80	Tabulations	10	10		10	60	,
13	Develop data to determine areas of streamhank ero- sion and thoodplain scour	SCS/Corp,	Hydraulics			Tabulations, maps, profiles	20	20		40	40	12
11.	Establish seasonal distribu- tion of floods	- SCS	Hydrology			Tabulation of percent chance that a flood will occur in a given month of any year				20		2
1.	.cmplete all data for eco- nowic analyses of existing flood damages	SCS	Hydrology	Dec 78	Jul 80	Tabulated data				40	20	é

Schedule of	hudrology	and hydraul	ica arudiaa	(cont)

					,		Corps o	f Enginee	rs egency	and disci	ervation	
				Start-	Com-			Engi- neering		Servi	Engineer -	
de	Work item	Responsible	Responsible discipline	ing	pletion	Product	Hydraulic	tech-		Hydraulic	ing tech	
			44444				engineer	HILLIAM	gist	engineer	nician	10(2)
	Stage II: Formulate Alterna Prepare Data for Structura	<u>tives</u> 1 Alternati	Ves									
6	Inventory and evaluate the physical potential for reservoir storage (in- ventory sites, determine	SCS Corps	Hydraulics Hydraulics	Oct 78 Aug 79	Oct 79 May 80	7 1/2-minute maps of sites, elevation varaus surface area and elevation storage curves		120	40	40	80	280
	storage potential)											
7	Establish hazard class and hydrologic criteria for design of selected sites (To and hydrologic criteria for PSH, ESH, and FBH)	SCS Corpe	Hydrology Hydrology	Oct 78 May 79	Aug 79 Aug 79	Tabulations			60	20		81
3	Hydraulic design of apillway for dams	s SCS Corps	Hydraulics Hydraulics	Oct 78 May 80	Jan 80 Aug 80	Elevations-discharge-storage data from SCS DAMS 2 pro- gram or Corps hydraulics programs	•		150	200	500	55
•	Locate reaches with limited shannel capacity	SCS/Corps	Hydraulics	Jan 79	Aug 80	Tabulations, maps, profiles	10	20		20		5
1	Hydraulic design of chan- nels and/or levess	SCS/Corps	Hydraulics	Jan 80	Oct 80	Plan view alignment, WSP print-out and drawings	500	500		120	80	1,20
1	Evaluate potential for recreation and fish and wildlife enhancement at potential reservoir sites (water budget studies, flow characteristics of streams)	SCS/Corps	Hydrology	Oct 78	May 80	Computer print-out, graphs, and drawings			40	50	50	14
	Evaluate Nonstructural Alt Evaluate and display non- structural alternatives	SCS SCS	Hydrology	Jan 80	Aug 80	Delineation on maps or mossics	30	20	30	40	80	20
	Evaluation and Display of Summarize hydrologic and hydraulics data for all alternatives, display results	Alternative SCS/Corps	<u>.</u>	Jan 80	Aug 50	Tabulations, maps, drawings	20		20	40	40	12
1	Stage II: Prepare Prelimina Prepare Hydrology and Hydr Write narrative report; pre- pare tables, graphs, etc., for report	aulice Sect	ion			Preliminary report and en- vironmental assessment	10		10	60	10	90
	Stage III: Complete Investi	gationa, Re	fine Analyses	of Alz.	ernetives	, Prepare Final Report						
	Finalize Evaluation of Exi Refine, verify, and run fina hydrologic and hydraulic models for existing conditions	l riod	Damages			Computer print-out	30		30	40	20	12
	Prepare final data for eco- nomic analyses of existing flood damages	scs	Hydrology/ Hydraulics	May 81	Aug 81	Tabulations	10		10	20	20	60
	Finalize Design of Structu Refine and verify hydraulic design of dam spillways	ral Plane as SCS/Corps	nd Eveluation Hydraulica	Oct 80	Apr 82	l Alternatives Computer print-out, drawings	100	100		50	50	30
	Refine and verify hydraulic	SCS/Corps	Hydraulics	Oct 80	Apr 82	Computer print-out, plan view drawings, and WSP's	300	200		50	50	60
	Refine data for evaluating nonstructural alternatives	SCS/Corps	Hydrology/ Hydraulics	Oct 80	Apr 82	Maps, tabulations	20		20	30	30	10
	Prepare data for economic analyses and environ- mental impact of alternatives	SCS/Corps	Hydrology/ Hydraulics	Nov 81	Jun 82	Tabulations	30	30	30	50	\$0	19
	Identify and Evaluate Sele Identify and finalize evaluation of welected plan	cted Plan. SCS/Corps	Prepare Inpu Hydrology/ Hydraulics	t to Fin Jun 82	Aug 82	t and EIS Data for economic and environmental evaluation of the selected plan	20		10	20		54
	Prepare hydrology and hydraulics inputs to	SCS/Corps	Hydrology/ Hydraulics	Aug 82	Oct 82	Final report and BIS	50		10	20		5
	final report and EIS											

# Engineering

The types of engineering studies that will be performed include geology, foundations, embankment-levee design, other design and cost estimates, and real estate. All of the studies undertaken will be accomplished using appropriate engineering standards, regulations, and guidelines.

Foundations. - The geotechnical investigation will be done in enough detail to permit selection of the most favorable project sites, determine the general type of structure best suited to the site conditions, and ascertain the costs of development.

The foundation investigation work will include a thorough search of existing soils and geology data; field mapping of exposed cuts, outcrops, and channel banks; a reconnaissance trip to establish site selection and alignment; the taking of soil and rock borings; laboratory testing of representative samples to establish design parameters; and investigation of borrow sources for major construction materials. These investigations will be of sufficient scope to support the proposed design, cost estimates, conclusions, and recommendations that relate to soils and geology.

Channel design would include riprap if necessary. Final design of the riprap would determine gradation, thickness, size and extent, and other erosion or scour preventive features. These designs would conform to current methods and criteria.

Reservoir and levee embankments would be designed to be safe against overtopping from the design flood and under extremes of operation. Embankments would not be designed to impose excessive stresses on foundation materials. They would have slopes that are stable under all conditions of impoundment operations. Seepage through their foundations and abutments would be controlled as necessary. Final design would conform to current design criteria.

All pertinent foundation, geologic, and survey information will be summarized in the final report. Detailed supporting data will appear in an appendix.

Layout, Structural Design, and Cost Estimates. - Embankments would be laid out on detailed topographic maps and typical sections would be prepared. Embankment quantities would then be computed. Outlet works would be laid out in plan sections. Preliminary structural designs would be undertaken as needed. They would be in accordance with appropriate criteria and guidelines. Structural quantities would be computed. Charts, illustrations, and plates would be prepared in accordance with drafting standards. Right-of-way requirements would be determined from layout of structures and embankments.

First costs for design features, including appropriate allowances for advance engineering, design, and contingencies, would be estimated in detail. Estimates of first costs would reflect prevailing price levels for similar work in the area. Annual costs, including appropriate allowances for operation, maintenance, and scheduled replacement of major project features, would be estimated based on the current interest rate.

The cost estimate and construction schedule for the selected plan will be summarized in the final report. Detailed supporting data will appear in an appendix.

Real Estate. - Real estate studies will be conducted using accepted policies and guidelines. Right-of-way and land ownership requirements in the floodplain would reflect costs of permanent and temporary easements, acquisition costs, relocation costs, land required for recreation and mitigation, severance payments, and other damages. These studies would be accomplished only in enough detail to indicate a gross appraisal.

The following table presents a summary of required engineering studies.

Schedule of engineering studies

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	- 11 - 15-	Š	•	det	Product	CS-11	GS-5 logger ator MAF neer		Lot MAF	1	id Labor	<b>1</b>		nat-tan	i	v10ry			
*01	Review anisting material for field recommulasance	8.3	2 28	8 Sep 79	At 78 Sep 79 Preliminary data	6,	•		!	:	Ę	; i		1		1		!	1
703	Field reconnaiseance	St St		×t 78 Sep 79	Reconnatesance	¥	*			2	-:		- :	•					
604	Detectains basard	š	Oct 78	8 Sep 79	43						7								
\$	Lay out soil borings	SUS/	Nov 78	9 Oct 79	Piteld location for boring crew	2								٠,		•			
ĝ	Determine uses to be investigated	SCS/	Nov 78	¥ 179							Ţ			_					
8	Obtain soil borings	SCS/	Dec 78	18 26 8	Boring logs and material for teating	10 67		107	201 201	2			*	3.8		~			<b>8</b>
407	Latabilsh C	SCS/	Nov 78	Dec 79	Define most suft- able location						Ē		-	~ *1		~			
<b>8</b> 0+	Lab testing (3)	Sus/	Dec 78	Dec 81	Define soil parameters for design	*			124 124				~	17					
60	Layout aurveys	SCS/	Dac 78	1 Dec 79	-						<b>3</b>			*					
914	Tie in soil borings	SCS/	3ec 78	Dec 81	-4						3	ii e		1 1					
;	Survey	SCS/	Jan 79	Jen 80	Survey notes						<b>\$</b>	162		, ,				· ×	
ą	Plot sell borings	SCS/	Jan 79	Dec 81	Profile of moil conditions at site			Ξ						7 28					
£13	Amalyze soil test results	SCS/	Peb 79	Dec 81	Define character- istics of material	. 6							^	32		2			
<b>‡</b>	Reduce and plot survey marks	SCS/	7.	Feb 79 Feb 80	Map of existing site conditions							ë		*					
£ .	Prepare soils map - site and drainage area	SCS	Ner 79	Dec 81	Soil map by site	67	5	2											
416	Determine sediment stor- age requirements	SCS	Mar 79	Dec 81	Design requirements	. 67	6												
<b>£13</b>	Determine floresplain dummages - occur and gully	8	Mar 79	Dec 81	Table of demages	¥	*												
418	Stability, seepage, and cottlement	Scs/	<b>7</b> 73	7 mg 4	Critical conditions controlling design	9 8				69			140	71 0		\$			
•1•	Deste	)	ž	8 4 8	Drawing (typical sec- tion profile)	į.				*			14 140	0 28		*			
62	Place II Layout	SCS/	E 7	9 Apr 80	Δ.						28	æ	**	28 28	\$				
421	Coordinate Phase II Leyout	)	<b>Fey</b> 79	9 Apr 80	Proper layout of 3	M. M.					;		7	28 14		^			
727	Earthmork quantities	25	May 79	<b>1</b> 50	-						61	e ī	-	1, 21					
ş	Structure design	\$0\$ / Corps	<b>FE</b> 7 73	7 May 50	Phase II drawings						<b>8</b>	ī	-	7.					
727	Coordinate structural design and coting	SCS/	Yey 79	o May 60	Compatibility of features	5					9		~	71 71			<b>*</b>		
\$3	Structure quantities	\$CS /	ď	79 May 80	Table .						ē	<u>.</u>	-	14 7					
929	Cost estimate	SCS/	5	9 May 80	1mble						<b>5</b>	162	^	70					
427	Raview cost estimate	SCS/ Sorpe	Aug 79	9 May 80	Confirm cost						ë		-	71					
428	Phase II plates	SCS/ Corps	Sep 79	9 May 80	Input to Phase II report	*					0,	162	7.	% %		,	7		
439	Phase II report write-up	SCS/	)ct /	9 May 80	Oct 79 May 60 Phase Il report	c				õ	183	324	14 133	3 28	63	4	<u>:</u>		

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10   Secretaria setal indication was 11 report   Copy	9	Nork item	agency	٠.	- 1		1 = 1				neer					Tech- Dr	Drafts- Super-	er- Sect	Secre- Survey Boring tary crew(1) crew(2)
10   Secretaria describation mapping   10   Secretaria	0(*	Raviss Phase II report	SCS/				10				01	0,		,	4			71 (	
13   Secretarist Place	117	Determine detailed mapping requirements										50			7.				
134	<b>717</b>	Mereluate Phase II results		0ct 80			11					122		^	7			7 14	
131 Lay out additional sort 1	ŝ	Revise atructure [1f required	SCS/	Nov 80								1,			,				
1.   1.   1.   1.   1.   1.   1.   1.	÷	Lay out additional soil borings	SCS/ Corps	Nov 80											2	^	1		
4.00   Part and state and	<b>43</b> 2	Lay out additional surveys	SCS/	Nov 80								0,							
	9.	Obtain soil borings	SCS/	.¥08											2		1		7
	<b>13</b>	Tie in additional soil borings	Scs/	98 c	Jen 82											,			,
4.00 Obtain additional surveys	2	Plot soil borings	SCS/	Sen 81											:				
Obtain additional entropy         SGZ/ Compty         Table 1 Feb 51 Mer 22 Survey notes         Lating continues         121         243         144           Analyze entil byrings and scripts         SGZ/ Compty         Peb 51 Mer 22 Indire characteristics of continues         122         243         154         144           Induce and plot surveys         SGZ/ Compty         Mer 51 Mer 52 Induced design         Residual structure         260         243         162         36         163         164         36         165         36         164         36	*	Soil lab testing (4)	SCS/	18 47	2										*				
Manalyse soull bortuge and   SGS/   Feb 81 Mar 82 Maffine characteristics of Leatures and plat surveys   SGS/   Feb 81 Mar 82 Mar 82 Mar 82 Mar 82 Mar 82 Mar 82 Mar 84 Mar 82 Mar 84 Mar 82 Mar 84 Mar 82 Mar 84 Mar 82 Mar 84 Mar 84 Mar 85 Mar 84	3	Obtain additional surveys	808	Jen 81		8						121	243			,			×
Reduce and plot surveys   SCS   Net 81 Net 82   Improved design   SCS   Net 81 Net 82   Improved geotechnical features   SCS   Net 81 Net 82   Improve geotechnical features   SCS   Net 81 Net 82   Improve geotechnical features   SCS   Net 81 Net 82   Improve geotechnical features   SCS   Net 81 Net 82   Improve geotechnical features   SCS   Net 81 Net 82   Improve geotechnical features   SCS   Improve geotechnical features (SCS   Improve geotechnical featur	<b>3</b>	Amalyze soil borings and test results	Sos S	7eb 81											2		1		
Passallyce and refine deading SCS/ Apr 81 Mar 82   Emproved deading Corps   Corps	3	Reduce and plot surveys	SCS/ Corps	7eb 81									<b>:</b>			28			
Raview final layout   SCS/ May 81 Apr 82 Drawing (plan, profile, section)   81 162   162	7	Resmalyze and refine design	SCS/	Mar 81							02	573	162		*	28	7		
Problem   Proper	ŧ	Pinalise layout	SCS/	Apr 81			tion)					<b></b>	162		<b>%</b>	*	<b>\$</b>		
Promitties	3	Review final layout	SCS/	Nay 81			:				10	0,		27	2	71	7		
Place structure   SCS   May 81 Apr 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   SCS   May 82 Table   May 82 Ta	3	Finalize earthwork quentities	SCS/	May 81								ī.			88	7,			
Finalize cost estimate   SCS/   Jun 81 Apr 82   Table	7	Finalize structure quantities	SCS/	May 81									89		*	:			
Review cost eartsate   SCS/   Jul 81 Apr 82 Confirm cost	97	Finalize cost estimate	SCS/ Corps	Jun 81								18	162		041				
Prepare report plates   SCS/ Oct 81 May 82 Report plates (main report and prepare report write—up   SCS/ Oct 81 May 82 Report plates and portions of   20   123   162   14   210	67,	Review cont antinate	SCS/	Jul 81								81			2		7		
Propage report write-up   SGS/ Oct 81 Nay 82 Appendixes and portions of   20   123   162   14   210   20   20   20   21   210   21   21	8	Prepare report plates	SCS/ Corps	Oct 81			7							<b>7</b>	78	126	,		
Mariow final report SCS/ Jun 82 Sep 82 Pinal input Corps 672 269 315 325 325 269 2,531 2,531 112 1,659	451	Prepare report write-up	SCS/ Corps	0ct 81	May 82						70	123			210	21	7 B6	82	
672 269 325 325 325 269 2,531 2,531 112 1,639	432	Raview final report	SCS/ Corpe	Jun 82		Finel input		,	1	}				1	2	=	4	*	1
		Total				•			325	323					659	700 294	7 500	112	70(1) 140(2)

(1) Crew days - three-man crew.
(2) Crew days - four-man crew.
(3) Crew days - four-man crew.
(4) Does not include Lincoin SGS lab cost. No time estimate available for Corps lab.
(4) No time estimate available for Corps lab.

# Erosion and Sedimentation

Studies will be undertaken to evaluate sedimentation and erosion concerns in the study area. The Minnesota SCS State resource conservationist will head up the work group. The work group will consist of representatives from soil and water conservation districts, the SCS area conservationists, and others as needed.

Available data from sources such as the Conservation Needs Inventory, Type IV river basin report, 208 Non-Point Sources of Pollution Inventory, and Resource Conservation Act will be used to the maximum extent possible.

Major work items include inventorying existing land use, determining level of land treatment applied, locating critical sediment producing areas, developing alternative land treatment programs, integrating resource data into other work groups, and contributing to the formulation and evaluation planning process.

Protection and management measures, including all types of conservation treatment and practices, are a basic need in the conservation, development, and use of land and water resources. The following factors will be evaluated to determine the need or lack of need for accelerated application of land treatment in the study area:

- 1. The extent and location of critically eroding areas.
- The extent and location of land needing treatment and the type of practices that, to an important degree, will reduce erosion and sediment, control runoff, conserve water, enhance fish and wildlife habitat, or improve water quality.
- 3. The acreage of land adequately protected and the kind and extent of land treatment now on the land that is meeting conservation needs.
- 4. The number and location of active cooperators and acres they control.

- 5. The number, acreage, and location of conservation plans where land treatment is already applied or in the process of being applied.
- 6. The extent and location of adequate soil surveys and other inventory data.
- 7. The ability of other ongoing programs to satisfy land treatment needs during the project installation period.
- 8. The extent to which local sponsors and landowners are willing to commit their resources to installing land treatment.
- 9. Work load estimates for additional soil surveys and planning, application, and maintenance of land treatment to meet land treatment goals during the project installation period.
- 10. Operations schedule, developed in keeping with other multiyear plans, for meeting land treatment goals.
- 11. Estimates of the cost of technical and financial assistance for planning, application, and maintenance of land treatment in the plan.

SCS policy in Minnesota requires that 50 percent of the land area upstream from a potential SCS reservoir site be adequately protected before the reservoir is built. Policy in South Dakota requires a higher level of protection. While SCS policy is not a constraint for possible Corps reservoirs, the Corps supports the concept that land treatment should be applied to the extent practicable with emphasis on critical areas that contribute sediment to any proposed structures or contribute to solving identified NED or EQ needs.

The following table is a schedule of Erosion and Sedimentation Work Group activities.

Schedule of erosion and sedimentation studies

						Man-Jay	rs by agen	Man-lays by agency and discipline	cipline	
Code	Work item	Respon- sible agency	espon- Start- Comple- sible ing tion gency date date	Comple- rion date	Product	State resource conserva- tionist	Soil conserva- tionist	Soil Area conserva- conserva- tionist tionists	District conserva- tionists	Total
510	510 Inventory present status (land treatment, erosion hazard)	SCS	Oct 78	Sep 79	Oct 78 Sep 79 Inventory	15	42	15	110	182
520	Preliminary report and environmental assessment inputs	SCS	Sep 79 Sep 80	Sep 80		15	42	15	140	212
530	Develop alternatives for land treatment	SCS	Sep 80	Oct 81	Sep 80 Oct 81 Proposed alternatives	15 7es	42	15	103	175
240	Prepare final report inputs	SCS	Oct 81	Sep 82	Oct 81 Sep 82 Selected program	20	115	20	06	245
Total										814
									3.7 man	3.7 man years

#### Economic

The Economic Work Group will perform all economic analyses related to the study. Included is a basin-wide study of existing and future without project demographic, economic, and agricultural conditions. The work group will provide the economic input needed for formulation of the NED plan and determine the feasibility of individual alternatives.

The economic evaluation will be based on interviews with about 5 percent of the floodplain farmers and other technical personnel. Interviews will be directed toward correlating the damage area and frequency of flooding determined by hydrologists, determining production costs, estimating land use and crop rotations, and documenting other agricultural damages to help develop damage factors. Upland farmers will be interviewed to help determine flood-free yields and cropping patterns. Local and State officials will be contacted to help determine damages to roads, bridges, and utilities.

Benefits from reducing flood damages will be determined using approved procedures. A stage-area-frequency procedure appears best suited to upstream areas; a duration-area-frequency procedure appears appropriate for downstream areas. ECON II will be used where possible in the upstream watersheds. Final determination on procedures will be made after the economist and hydrologist have more extensively examined the damage areas.

Soil scientists and district conservationists in each county will be consulted with to determine the economic benefits derived from cropland enhancement. The economist will determine floodplain land use for with and without project conditions and supply this information to other disciplines as needed.

#### The economist will:

- Help the recreation specialist formulate and evaluate recreation plans for any structures that have recreation potential.
- 2. Assist the soil conservationist in developing land treatment needs and costs.
- 3. Participate in public meetings and provide assistance to the local sponsors in making decisions relating to the NED components of the alternatives.

The following table summarizes the economics work needed for the study.

Schedule of economic studies

		D		0			ed time in man	-days
		Respon- sible		Com- pletion		Soil Conserv		
ode	Work item	agency	ing date	date	Product	tion Service	Corps of Engineers	Total
	I. Problem Identificat	ion						
nt)!	delineate benefit area	Scs/	Oct 78	Nov 78	Map	20	10	30
	Office preparation	Corps			•			
	belect sample area	SCS/ Corps	Oct 78	Nov. 78		15	5	20
	Maps and other items	SCS /	Oct 78	Nov 78		8	2	į su
	needed	Corps	000 70	NOV 76			2	1.7
	Select economic	SCS /	Our 78	Nov 78		8	2	10
	reaches	Corps	000 76	.400 70		ō	2	1.7
	Asta Collection							
en l	Field reconnaissance	SCS	Oct 78	Feb 79	Tables, parrative	10	-	10
613	Field interviews	SCS/ Corps	Nov 78	Dec 78	Tables	40	20	60
	Technical interviews	scs/	Nov 78	Dec 78	Narrative	15	5	20
	(district conserva- tionists, soil scientists, resource	Corps						
	people)							
604	Sediment and scouring a	SCS/ Corps	Dec 78	Jan 79		25	15	41
115	Determine land use	Scs/	Oct 78	Nov 78		15	15	30
06	Crop vield data	Corps SCS/	Dec 78	Jan 79		20	-	20
	Product and took to a low	Corps	V 70			2.5	2.5	
11.7	Road and bridge data	SCS/ Corps	Nov 78	<sup>†</sup> an 79		25	25	50
าปธ	Land treatment needs	SCS/				90	-	40
509	Soil data	Cerps SCS	Nov 79	Dec 79		10	_	10
10	Summarize interviews	SCS/		Feb 79	Tables, charts, narrative	60	30	90
• (/	and analyses	Corps	Jan 79	160 /4	lables, charts, harractive	QQ.	30	90
	Namage Determination							
11	Develop crop budgets  [Crop Tulget Generator System)	SCS/ Corps	Feb 79	Jun 79	Computer print-outs	45	-	45
42	Develop damage values	scs/	Feb 79	Oct 79		90	30	120
13	and factors Run ECON II on upland	Corps SCS.	tun 79	Feb 80	Computer print-outs	110	20	130
	and appropriate pro- cedures on other	Corps	, ,		ompace principals	***		
14	Summarize damages	SCS/	Mar 80	Apr 80	Tables, narrative	35	15	50
15	Develop present and	Corps SCS/	May 79	Feb 80		30	50	80
	future damages without project	Corps						
16	Develop other damages (sediment and erosion,	SCS/ Corps	May 79	Feb 80		40	40	80

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				ile of e		Estimated	time in man	-davs
		Respon-		Com-		Soil Conservation	Corne of	
		sible	ing	pletion	0 . 1	Service		Total
de.	Work item	agency	date	date	Product	Service	Engineers	10,541
	II. Plan Formulation and Ev	aluation			Tables, charts, narrati			
17	Develop damages for various	scs/	May 80	Oct 80		1 50	100	250
	alternatives	Corps SCS/	May 80	101.80		50	20	<b>7</b> 0
18	hevelop changed land use benefits	Corps	114 y 055	.741 0.7				
19	Develop more intensive land	SCS/	May 80	Jul 80		50	20	70
	use benefits	Corps				-	10	10
20	Local employment benefits	Corps	Jun 80	Jul 80		20	117	20
21	Secondary benefits	SCS	Jul 80	Aug 80			-	50
122	Orainage benefits	SCS	Jun 80	Aug. 80		50	30	30
23	Other benefits	Corps		Aug 80		1.5	-	30
524	Identify NED plan	SCS/ Corps	Sep 80	Sep <b>8</b> 0		15	15	
25	Identify FQ plan	SCS/ Corps	Sep 80	Sep 80		5	5	10
26	Formulation of selected	scs/	Sep 80	0ct 80		15	15	30
	plan	Corps		. 00		15	15	30
27	Recreation benefits and	SCS/	$M_{\rm eff}$ 80	Aug 80		1 )	1 )	,,,
	needs	Corps						
	III. Benefit-Cost Estimates						60	120
523	Cost allocation, cost	SCS/	Det 80	Dec 80	Tables	60	60	1=9
	sharing	Corps						
	IV. Plan Proparation					0.0		120
529	Account display, write-up	SCS/	Dec 80	Oct 81	Displays	80	40	150
		Corps						
	V. Plan Review					20	15	35
h (H	Attend public meetings	ECS./ Corps	Oct 80	Oct 82		20	1.7	1)
631	Travel	SCS/	Oct 80	Oct 82		10	10	20
		Corps						
532	Praft review	SCS/ Corps	Aug 81	Oct 81		35	35	70
533	Final review and comments	SCS/	Apr 82	Nov 82		40	35	75
		Corps						
	lotal					1,316	709	2,025
						6.0	3.2	9.2
						man-vears	man-vears	mar-ve

#### **Environment** al

The Environmental Work Group will determine the important ecological, cultural, recreation, and social resources of the study area. It will develop plan components (for inclusion in alternatives) to improve the natural and human environments. The environmental assessment process will identify the impacts of alternatives on the study objectives and natural and human environments.

The work group will conduct literature searches, field studies, and evaluations using a systematic, interdisciplinary approach to planning. Work group inputs and monitoring of the study will assure that biological, recreational, cultural, and social resources will be fully considered during planning and decision-making. Study managers will be kept informed of applicable legislation, rules and regulations, guidelines, and executive orders on land and water resources planning to assure full compliance. Liaison with Federal, State, and local groups with expertise or interest in biological, recreational, cultural, and social resources will be maintained throughout the study.

Current and future environmental resources conditions will be determined. In-field evaluations will be conducted at impact zones to provide authoritative basis for preparing reports, recommendations, environmental assessment, account displays, mitigation or enhancement plans, and inputs to the draft report and environmental impact statement.

Four subgroups have been established:

- Biological Resources Subgroup. Biologists representing the SCS, Corps, U.S. Fish and Wildlife Service, and State agencies will:
  - a. Gather data, conduct field studies, and evaluate the biological resources of the study area.
  - b. Determine current and future ecological systems and conditions.
  - c. Investigate opportunities to restore, create, or enhance fish and wildlife habitat.

- d. Develop environmental quality components to be included in the alternatives.
- e. Identify and analyze potential impacts of plan elements on fish and wildlife and ecological systems.
- f. Maintain coordination with other work groups so that adverse impacts can be avoided, minimized, or mitigated early in the planning process.
- g. Conduct detailed in-field evaluations at selected impact zones.
- 2. Recreation Resources Subgroup. Corps of Engineers outdoor recreation planners and landscape architects will coordinate studies of recreation resources with Federal, State, and local agencies and applicable outdoor recreation plans. Overall guidance and coordination responsibility for recreation inputs will be provided by the SCS work group chairperson. The work group will:
  - a. Investigate and document any recreation demand that could be satisfied by feasible recreation features incorporated in all alternatives. Recreation studies will include feasibility-scope designs and cost estimates of proposed features.
  - b. Establish the location and extent of any lands required for recreation measures.
  - c. Determine monetary benefits of satisfying recreation needs.

Project-related features that might be considered include, but are not limited to, camping and picnicking facilities, boat docks, swimming areas, hiking and biking paths, scenic overlooks, and pedestrian bridges and other accesses. Provisions for use of the facilities by the elderly and handicapped will be included in the designs of recreation features. Appropriate drawings, sketches, and illustrations will be included in the report and environmental impact statement. A high degree of public participation will be maintained.

3. <u>Cultural Resources Subgroup</u>. - Corps of Engineers archeologists will coordinate studies of archeological and historical resources with Federal, State, and local agencies. Liaison with State historic preservation officers and the Heritage Conservation and Recreation Service will be established early and maintained to assure full compliance with applicable Federal and State regulations and procedures concerning cultural resources. The work group will also:

- a. Conduct literature searches, data collection, field studies, contracts, and evaluations to identify the cultural resources of the study area.
- b. Develop cultural improvement components for inclusion in the alternatives.
- c. Identify and analyze the potential impacts of plan elements on cultural resources.
- d. Maintain coordination with other work groups so that adverse impacts can be avoided, minimized, or mitigated early in the planning process.

A contract with qualified individuals will provide for detailed field investigations at impact zones. Overall guidance and coordination will be the responsibility of the SCS work group chairperson.

4. Social Analysis Subgroup. - Corps of Engineers sociologists will coordinate studies of the social resources with Federal, State, and local agencies. Overall guidance and coordination will be the responsibility of the SCS work group chairperson. Coordination will be maintained with the other work groups so that adverse impacts can be avoided, minimized, or mitigated early in the planning process. All social analyses will be performed in accordance with the expressed and implied intent of the Principles and Standards of the Water Resources Council and all regulations and guidance of the SCS and Corps.

The work group will develop a social profile of the population in the study area. Profile characteristics include data on employment, age distribution, education, and other descriptors which specify the composition and organization of the local social system. The profile will be comparative by providing parallel information on the study area and the State and, on some items, the Nation. The social effects generated by each alternative such as relocation of homes, changes in development patterns, public safety, and aesthetic perceptions will be compared to the base line social profile. Special emphasis will be placed on determining these effects on underprivileged, handicapped, aged, or minority groups. The analysis will estimate, relative to the State or national comparative base, whether the local inhabitants gain or lose with the selection of a given alternative. An assessment and evaluation of the social effects of possible nonstructural and structural plans for the study area and the degree of problem resolution will be made.

Studies will include an institutional analysis to insure that all affected individuals, offices, agencies, and groups are included in the investigation and coordination. An inventory will be compiled of all organizations having functions or interests relevant to water resources planning. The goals, resources, and legal and customary functions of each organization will be specified to give a clear picture of the area's commitments and capabilities. The capability of the existing institutions to implement, manage, and finance each alternative will then be analyzed. Modifications to the existing institutions and/or the need for new institutions will also be investigated.

The following tables present schedules of the Environmental Work Group studies.

Schedule of	environmental	atudies .	. hiningical	PARCUITCAR	auberous.

				Schedul	e of environmental studies -	- biologica								
		Respon-	Start	_			SC\$	n-days	by agency	and die	cipli	ne		
C-4.	0	sible	ing	Comple-			DC tech		Corps			r biole		
Stage	Work item II: Fish and Wildlife Inver	agency	date	tion dat	e Product	Biologist	nician	Total	biologist	MONR	FWS	SDDNR	Total	Tota
701.1	Review inventory work for Type IV study. Revise wildlife count and har- vest data and habitat inventory to reflect new basin boundary. Gather updating wildlife count and harvest data	SCS	Oct 78	Dec 78	Updated tables from Minne- sota River basin report	2	-	10	-	2	-	1	3	1.
701.2	Inventory number, loca- tion, and acreage of lentic bodies 10 acres or larger and the general type of fisheries they support	scs	Oct 78	Feb 79	Мара	3	-	3	-	3	-	1	4	
701.3	Location and miles of all continually flowing streams and rivers with general abundance of im- portant fish species (em- phasis on trout streams)(1	scs	Oct 78	Feb 79	Color-coded map showing warm and cold water stream segments	3	-	3	3	5	3	2	1	16
701,4	Location of areas particu- larly notable or important for itsh and wildlife (wetland inventory; deer and pheasant winter areas; all WM's, WPA's, easement and porential areas; fish spawning areas; endangered species)	s,	Oct 78	Feb 79	Locations of county maps	5	7	12	5	12	5	2	19	36
701.5	Inventory wildlife habitat by cover type (based on estimates derived from LIM sample plots (40 acres and comparison to CMI up- date figures)	scs	Mar 79	Oct 79	Tables	3	-	3	-	-	-	-	-	1
701.6	Determine average habitat unit values by cover type with 200 random samples and interagency team analyses of collected field data (LIM system with Iowa State)(2)	SCS	Mar 79	Oct 79	Narrative descriptions, methods, tables	25	220	245	20	20	20	-	40	305
5tage 702.1	II: Develop Plan Components Develop EQ components and predict future without conditions	and Im	Oct 79	Mar 80	Tables, maps, narratives	5	-	5	5	5	5	-	10	20
702. <b>2</b>	Impact analysis of NED components by grouping into similar impact areas	SCS	oct 79	Mar 80	Narratives, tables, maps	100	-	100	120	40	40	-	80	300
702.3	Impact analyses of alterna- tives, displays of account Determine mitigation needs		Jan 80	Apr 80	Narratives, tables, inter- agency reconnaissance biology report	60	-	60	60	60	60	-	120	240
	II: Preliminary Plan and En Praft sections of report	vironme	ntel Ass	essment										
	and assessment	SCS	Feb 60	May 80	Reports, tables, maps	20	-	20	20	10	10	-	20	60
*94.2	Coordination and public meetings		Oct o	Sep 80		25	-	25	25	25	25	-	50	100
101, 3	Review and comment on draft Stage II report and environmental assessment		May 80	Sep 80	Comments	10	10	20	_10	10	10	10	30	60
Total	Stage II							508	268				389	1,165

		-						Man-d	ays by age	ncy at	nd dis	cipline		
		Respon-	Start-				SCS							
		sible	ing	Comple-			DC tech		Corps			biolog		
Code		agency		tion date	Product	Biologist	nician	Total	biologist	MDNR	FWS	SDDNR	Total	leta
	III: Reanalysis of Impleme													
704.1	Review preliminary data developed during Stage II for updated needs and additional information needs	SCS	Oct 80	) Nov 80		5	-	5	5	5	5	-	10	21
704.2	Fish and wildlife habitat appraisals by structure sites (in-field HEP analysis) Prepare for analysis from photos, maps, engineer- ing group Transfer field data to forms and computer analysis of data (3)	scs	May 80	) Sep 81	Maps, tables, narrative	90	10	100	90	90	90	-	180	370
70⊶, 1	Appraisals of sites for fish and wildlife devel- opments, improvements, mitigation, or enhancemen	SCS t	Sep 80	Sep 81	Maps, tables	20	10	30	20	20	20	-	40	90
704.4	Update impact analysis of alternatives and display of accounts	scs	Jan 81	Sep 81	Tables, narratives, account displays	20	-	20	20	20	20	-	40	80
stage	III: Selection of Recommen	ded Plan	n											
705.1	Identify impacts of selected plan elements	SCS	Sep 81	Dec 81	Tables, narratives	20	5	25	20	20	20	-	40	85
705.2	Trade-oft analysis and dis plays of accounts	- SCS	Sep 81	Dec 81	Tables, account displays	25	-	25	25	5	5	-	10	60
*15,3	Mitigation needs and/or enhancement of selected plan on fish and wild- life resources	SCS: Corps: FWS:/ DNR	Sep 81	Feb 82	Interagency biology repo	rt 20	10	30	20	20	20	-	40	90

Sep 81 Mar 82

SCS Apr 82 Jul 82 Comments

Mar 82 Sep 82

Determine need for fishery surveys (under contract).
 Field collection of LIM data by district conservationists. Analysis of raw data by Iowa State and quad-agency team.
 Sites grouped into similar impact zones and representative sites evaluated by quad-agency biology team with full FWS HEP.

Note: MDNR - Minnemota Department of Natural Resources. FWS - Fish and Wildlife Service. SDDNR - South Dakota Department of Natural Resources. HEP - Habitat Evaluation Procedures.

205.4 Coordination and public

706.1 Draft sections of final report and EIS 206.2 Informal review and com-ment on final report and EIS

706.3 Coordination and public meetings

Total Stage III

meetings

Stage III: Final Report and Environmental Impact Statement 70b.1 Draft sections of final SCS Feb 82 May 82 Reports

 535 1,225

				_			y agency an	d discip ine	
	R Work 1 tem	esponsible agency_	Starting date	Completion date	Product	Archeologist (Corps)	Biologist (SCS)	Contractor	Total
<u>ode</u>		unchey.				<u> </u>	<u> </u>		
Stage I	I: Inventory of Cultural Resources Administer contract for record and literature review, informant con- tacts at potential reservoir sites, etc. (prepare U.S. Geological Survey maps with approximate boundaries of reservoir sites, channel and levee work, etc.; prepare scope of work and centract; negotiate contract; monitor contract work progress; review con- tractor report)(1)	Corps	Oct 78	Sep 79	Cultural remourceme report and maps	80	20	120	220
711.2	Coordination and public meetings		Oct 78	Sep 79		20	5	-	2.5
	It: Develop Plan Components and Analyze Im Bevelop cultural resources section for alternatives and analyze impacts (develop cultural inputs to EQ plan, analyze impacts of NED components, analyze impacts of alternatives, make input to account displays)	pacts Corps	Oct 79	Mar 80	Cultural resources report sections and displays	55	1)	-	65
	ii: Preliminary Plan and Environmental Ass	Corps	Feb 80	May 80	Report sections				
	Coordination and public meetings	Corps	Oct 79	Sep 80	Report dections	7	5	_	12
	Review and comment on draft Stage II		May 80	Sep 80	Comments	5	5	-	10
,,,,,	report and environmental assessment		,		¥	_	_	_	
Total 3	Stage II					167	45	120	332
	III: Reanalysis of Implementable Plans Administer contract for reconnaissance survey of proposed structure sites, -hannel work, and levees (update U.Seological Survey maps of impact areas, prepare scope of work and contract negotiate contract, monitor contract work progress, review contractor report)(		Apr 80	Apr 81	Report with completed site forms and recommendations for further detailed testing		15	700	815
714.2	Update impact analysis and account displays		May 81	Sep 81	Tables, narratives	30	10	-	40
714.3	Coordination with other groups		Apr 80	Sep 81		15	5	-	20
	III: Selection of Recommended Pian Identify impacts of selected plan ele- ments on cultural resources	Corps	Apr 81	Jan 82	Report with site maps and undated account displays	20	10	-	30
213.2	Award and administer contract for in- rensive testing of selected potential sites of impact areas to determine eligibility and impacts, mitigation, or re-overy needs (2)	rps	Apr 81	Jan 82	Gultural report with nomi- nating forms, mitigation recommendations, etc.	40	10	400	450
1,5,3	Mitigation needs and or enhancement of selected plan on cultural resources		Dec 81	feb 82	Tables, narratives, reports	30	10	-	40
111.4	Coordination and public meetings		5ep 81	Mar 82		10	5	-	15
	Iti: Final Report and Environmental Impact Draft sections of final report and EIS	Statement	Feb 82	May 82	Report sections	60	10	_	70
	Informal review and comment on final report and EIS		Apr 82	Jul 82	Comments	20	5	_	25
na, i	coordination and public meetings		Sep 81	Sep 82		_10	5		15
	rage [[]					335	85	1,100	1,520

	ı	Total lota	13 38	6 29	- 17	10 63	- 28	10 4C	58 18	37 8:	<b>30</b>	28 182	
		Contractor I	,		1	ı	1	1	5	·	1	1	
Other	Local govern-		52	1	1	1	1	1	30	25	t	20	
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	State recreation		1	-	•	5	ı	5	e .	10	•	ç.	
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		lotal	\$2	22	13	90 -7	13	5.2	6111		7.5	140	
ngineers	Outdoor recre-	planner	1.5	2	01	, yo	10	10	9	52	0	0,7	
Corps of Engineers	visory land-	test architect	7.	†	7	-		٠.	61	67	יי	70	
اتا	Land- scape ar.hf-	te, t	30	r	S.	Page 10-2	~1	10	07	5	30	08	
		Product	Possible summary (a), le of existing re-reat: n plans	ipdated inventory of restraction facilities	lable of recreation supply	lable of recreating demand	Incorporate data into- previous recreation work item products	Table of facility and activity needs	Maps, tables, charts of potential development areas	Description of public describers for recreation	Matrix, table	Drawings, maps, account displays	
	staff completion	ļ	Oct 78 Dec 78	** ** ** ** ** ** ** ** ** ** ** ** **	Dec '8 Feb 79	or 18 Mar 79	eb 29 Mar 79	Jan 79 Mar 79	Jan 79 Sep 79	0.t 28.Sep 79	Act 79 Jan 80	Nov 79 Feb 80	
	Responsible		Outdoor recre- ation planning	o tps outdoor rector	Outdoor re . atfoc planning	outdoor recre- ation planning	Biology and mit ceb door recreation planning	60	Dutdoor recreation planning	SCS/ Biology and out=0,t/29 orps door recreation planning		Corps outdoor recre- attom planning	
	Kesp n	A gage	rd :	t ps	Ser ps	eqr.	S.C.S	Corps	Corps	SCS/ Corps	Corps	Sorps	
		ACT'K ITEB	Name   Corentory - Ne resting sevent es 221   Restew previous arts One   Determine **Patrick of the control o	btain State imporer printing of existing recentling addition, review SQMP data for the basin and bittin an LIA of shemile radion, boundary by courts.	Analyze present facility dapadites and dapadities to determine supply	Analyze recreation tenand using STORP's population projections and participation rates, comparisons to statist projects.	obtain and analyze products of fish and and wildlife subgroup (701.2,3, and wildlife subgroup (701.2,3), and wildlication to refreation task	retermine retreation needs by various Corps. Outdoor recre-	Inventory and analyze resources capabilities for receasion development (proposed acquisition areas from ounty and local plans, single-proposed appointment sites in the Winnessta Mixer basin Type IV repiti, etc.)	ovidination and public meetings - emphasis on condination with solat analysis subgroup	Preliminary   recomponents and Impact Analysis   resident on VED, EQ, etc.), Corps Outdoor recre- recomposition and megative and megative ation planning   recreation, provide   on a service parential recre-	Design of the second of the se	
		ode	Stage 721.1	<u></u>	į.	721.4		221.0	5	•	<u>.</u>		

•									1	en day	Men days by agency and discipline	and disci	pline		
							Corps of Engineers	ngineers	1			100	,		
						Land-	ATROLA	Outdoor		1	State				
	Respon-		Start-	Comple-		scape	Lend-	Tecre-	<b>5</b> 7		recreation	Local			
100	et ble	Responsible	ğ ;	tion	Pared	erchi-	scape ation		10.0	biolo-	Mane- South	•	Canada and and and and and and and and an		
Stage II: Preliminary Plan and Finel Enviro	omental.	Ange sement	991	8814	1	П	Brentiect				DOLE DEKOL	Ĭ		100	10101
723.1 Develop drafts of report and environ- Corps Outdoor re memtal assessment	edico.	Outdoor recre-	May 80	Jun 80 Report	Report	9	∞	<b>8</b>	128	<b>6</b> 0	1	•	ı	•	136
723.2 Prepare places and maps for reports	Corps		May 80	Jun 80		16	77	<b>c</b>	84	•	4	•	,	77	3
723.3 Beview and comment on draft Stage II report and environmental assessment	Corps	Outdoor recre-	May 80	Sep 80	Comments	01	01	•	22	<b>'</b>	91	9		8	8
723.4 Coordination with other work groups	Corps	Outdoor recre-	Oct 79	Sep 80		25	22	,	2	잌	•	•	1	·l	69
Total Stage II									925	*				<b>95</b>	1,327
Stage III: Revaluation of Implementable Plans 724.1 Enviou of data used in Stage II Corps	Corps	Outdoor recre-	Oct 80	Dec 80	Updated tables, charts	16	16	-	33	-	•	•	ı	22	×
724.2 Review appraisals performed by bio- logical resources subgroup to determine effort on proposed recre- ation development plans. Revise where secessory.	Corps	Outdoor recre- ation planning	8 9 8	Sep 81	Revised site plans, etc. 40	<b>\$</b>	<b>ç</b>	2	8	8	•	1	1	1	110
724.3 Procest ravioed place to public at a series of vortehope. Obtain comments.	8 8	Miology and out-Jun 81 door recreation planing	16 H	Sep 81	Comments	91	*	•	9	•	12	35	t	\$	ş
724.4 Make final revisions to place, costs, and benefits (spinted impact smaly—size of alternatives and account displays.	Ser ye	Outdoor recreation tion planning	A 21.	. Dec 81	Plans, tables, account displays	8	*	•	3	•	•	•	ı	• .	3
Stage III: Selection of Recommended Plan 725.1 Identify impacts of selected plan on recreation resources	8	Outdoor recrea- Sep 81 tion planning	Sep 81	Dec 81	Tables, narratives	8	92	2	8	•	01 00	•	•	20	ĸ
725.2 Trade-off analysis and displays of accounts	Carry	Outdoor recree- Sep tion pleming	Sep 81	Dec 81	Tables, account displays	2	2	•	22	•	2	•	ı	115	\$
725.3 Mitigation meets and/or banefits of selected plan on recreation resources		Mology and out-Sep 61 door recreation pleasing	-Sep 61	7eb 82	Tables, nerratives	9	9	'n	ង	•	s.	•	ì	ສ	ş
725.4 Coordination and public meetings			Sep 81	Mar 82		27	21	•	£	•	\$	•		2	88
Stage III: Visel Report and Brvirosmestal Impact 726.1 Draft sections of final report Corp. and EIS	20 00 00 00 00 00 00 00 00 00 00 00 00 0	Statement po Outdoor recrea- rion planning	38 82	May 82	Reports	\$	3	•	8	*	21 21	3	ı	3	*
726.2 Informal review and comment on final report and RIS	Contra	Outdoor recreetion tion pleaming	<b>Арт 82</b>	Jul 82	Comments										
726.3 Coordination and public meetings			Mar 82	Sep 82		•	•	-	-i	~	7	~	•	4	7
Total Stage III									5	3				S	12

					vironmental studies - social and	Ma	n-days		and discip	ine	
		Respon- sible	Start- ing	Comple tion	-	Sociolo-	Engine Super-	ere	scs	Con-	
Code	Work item	agency	dat <u>e</u>	date	Product	gist (two)	visor	Total	biologist	tractor	Total
731.1	II: Social Analysis Inventory Social profile (identify signifi- cant social factors, determine level of investigation, ad- minister contract for social profile (prepare scope of work and contract, negotiate contract, monitor contract work, review contractor reports, literature search and field interview work)	Corps	Oct 78	Har 79	Reports, narratives (projection of alternative future without action)	12	2	15	2	40	57
	Coordinate with public involvement work group and public meetings(1)	COTDS	Oct 78	Mar 79		1					
731,2	Institutional analysis (consult with study managers to establish specific studies needed and scope of analysis, prepare scope of work and contract, administer contract for institutional analysis and monitor contract progress, review contractor reports)(2)	-			Institutional analysis report	40	5	45	10	120	175
Stage	II: Develop Plan Components and Ans	lyze Imp	acts				_				
732.1	Develop possible social well-being improvement components	Corps	Oct 79	Mar 80	Reports, narratives	20	2	22	5	-	27
732.2	Develop social well-being accounts and analyze impacts of alterna- tives. Determine possible miti- gation plans.	Corps	Jan 80	Apr 80	Display accounts, narratives, and reports	25	2	27	5	23	55
Stage 733.1	II: Preliminary Plan and Environmen Draft sections of report and en- vironmental assessment			May 80	Reports, tables, graphs, narratives	60	6	66	10	-	76
733.2	Coordination and public meeting		Oct 79	Sep 80		16	2	18	4	5	27
733.3	Review and comment on draft Stage I report and environmental assessmen		May 80	Sep 80	Comments	15	5	20	_5	<del>-</del>	_25
Total	Stage II							213	41	186	442
Stage 734,1	III: Reanalysis of Implementable Pl Review Stage II data for updated needs and additional study needs	ens Corps	Oct 80	Dec 80	Updated preliminary social date	. 3	-	3	-	-	3
734.2	In-field investigations of social impacts of alternatives (field-work by contract) (3)	Corps	May 80	Sep 81	Maps, tables, narratives	54	5	59	5	160	224
734.3	Updated impact analysis of alterna- tives and account displays, miti- gation needs. Implementability analysis of remaining plans.	Corps	Jan 8 <u>1</u>	Sep 81	Maps, tables, narratives, account displays	130	3	133	10	-	143
	Study recommendations for institu- tional change based on institu- tional and implementability analys		Apr 81	Sep 61	Recommendations for possible changes of institutions to implement and maintain recommended plan	17	2	19	5	10	34
Stage 733.1	III: Selection of Recommended Plan Identity Social impacts of selected plan elements	Corps	Sep 81	Dec 81	Narratives, maps, tables	20	-	20	3	-	23
735.2	Trade-off analysis and displays of selected plan elements	Corps	Sep 81	Dec 81	Tables, account displays	20	-	20			20
735.3	Mitigation needs and/or enhance- ment of selected plan for social well-being	Corps	Sep 81	Feb 82	Maps, narratives, tables	60	10	70	10	-	80
735.4	Coordination and public meetings		Sep 81	Mar 82		10	-	10	2	-	12
736.1	III: Final Report and Environmental Draft sections of final report and EIS				Report sections	40	5	45	10	-	55
736.2	Informal review and comment on final report and EIS	Corps	Apr 82	Jul 82	Comments	30	10	40	5	-	45
736.3	Coordination and public meetings		Mar 82	Sep 82		7	2	9	_3	<u>-</u>	12
Total	Stage III							428	53	170	651

<sup>(1)</sup> Contract estimate = \$7,500. (2) Contract estimate = \$23,500. (3) Contract estimate = \$17,500.

#### Water Quality

Water quality studies will be done to insure that any proposed projects do not adversely affect the water quality of the study area lakes and streams. Many of the streams and creeks flow intermittently in dry ravines; others are spring-fed. Waters are alkaline with hardness ranging to more than 1,000 mg/l in the western part of the study area. Water quality and hydrologic data for the streams and creeks are almost nonexistent.

Three methods of conducting water quality studies were investigated:

- 1. Method A would have a water quality and ecosystem mathematical model approach. A set of water quality data for each proposed reservoir site would require at least 2 years of continuous streamflow, temperature, and specific conductance measurements and weekly monitoring of stream water quality for 20 parameters during spring runoffs. Monthly monitoring of water quality is considered sufficient for the rest of the year, except for special monitoring during storms. Costs for this method are estimated at about \$200,000 for each site investigated. This figure includes costs for data collection, model study, and a final report. Costs would be excessive if each potential reservoir site were investigated.
- 2. Method B would involve sampling about five representative reservoirs and five or more sites on nearby streams where impoundments are possible. All trout streams that would be affected would also be sampled. Stream gaging and water quality sampling stations would be required upstream and downstream from each of the existing representative reservoirs and on each of the streams to be sampled. Correlations of data on inflow, pool, and outflow could be made with data collected at the representative stream sites. Weekly sampling of all stations during spring, summer, and fall would be required for 3 years to develop a sufficient data base for statistical reliability. Costs for this method are estimated at \$700,000.

3. Under method C, water quality sampling would be confined to only the pools and outlets of existing reservoirs in the study area. The pool data would be used to classify reservoirs according to their relative trophic states and other water quality indexes. Outlet monitoring would determine compliance with water quality standards. This type of sampling program would also provide information on the limnological behavior of the existing impoundments. The information could be evaluated with respect to reservoir morphometry. Land use and other basin characteristics correlations could be used to describe proposed reservoirs. Stream gaging stations and monitoring of flow would not be necessary. The inherent difficulty of obtaining adequate water quality data from intermittent streams would be eliminated. Costs for this method are estimated at \$490,000. This cost was used for the study cost estimate.

The range of water quality issues and a method of study were coordinated with representatives of the Environmental Protection Agency, Minnesota Pollution Control Agency, and South Dakota Department of Environmental Protection. The issues and some of the conclusions from discussions during coordination meetings are shown in pertinent letters in appendix B. Generally, the agencies' representatives favored a method of study similar to method B but with monitoring done four times a year.

The Minnesota Pollution Control Agency later expressed in an 8 August 1978 letter that the study method should include predictive modeling, evaluation of the impacts of improvements on downstream water quality and flow, impact of dry dams on water quality, and monitoring of pesticides and herbicides. The Environmental Protection Agency in a 2 August 1978 letter stated the need to alert communities with municipal effluent discharges into potential reservoirs of the potential

need for additional treatment. The South Dakota Environmental Protection Agency, in its 18 July 1978 letter, stated that stream use regulations could not be downgraded by project development, the impacts of dry dams should be judged case by case, three to six reservoirs could adequately represent prospective sites, and frequency of sampling reservoir inflow should depend on its variability which might require more frequent sampling than the four times a year for impoundment and outflow waters.

Method C was used for the following study schedule and study cost estimate. It has the lowest cost of the three methods and would provide the most practical, reliable results. Further coordination between State and Federal agencies is required before adopting a specific method for water quality studies.

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		Responsible	Starting	Completion	Ę.	Eng1-	Tech-	Secre-		eng1-	
8	Work item	agency	date	date	Product	neer	nician	tary	Total	neer	Total
800	Obtain reservoir land use and damage maps	Corps	Dec 78	Jan 79	U.S. Geological Survey maps	9	t	٠	9	•	<b>9</b>
810	Land use snalysis of reservoir demage areas	Corps	Jan 79	Jan 80	Land use percentage tabula- tion for each reservoir drainage area	240	•	ı	240	54	764
820	Field reconneissance	Corps	Мау 79	Jan 80	Inventory of access roads, local feedlots, topography, land use, sources of water, and water use	9	•	1	8 .	•	99
825	Water quality inputs to preliminary report and environmental assessment	Corps	Oct 80	Feb 81	Preliminary report and environmental assessment	120	07	07	200	12	212
830	Selection of representative sites	Corps	Jan 80	Jan 80	Identify sample sites	10		•	10	7	12
<b>8</b> 0.	Prepare and execute contract for sampling	Corps	Feb 80	Feb 80	Select contractor	70	1	,	20	m	23
850	Sample	Corps	Mar 80	Mar 82	Samples	8	180	7	217	4	221
860	Sample analysis	Corps	Mar 80	Mar 82	Analysis of samples	ı	217	,	217	ı	217
870	Data review and analysis	Corps	Mar 81	Apr 82	Tabulations, graphs, correlations	250	1	•	250	25	275
875	Inputs to formulation and evaluation of alternatives	Corps	Apr 81	Dec 81	Tabulations	9	ı	ı	09	ø	<b>39</b>
880	Water quality inputs to draft feasibility report and EIS	Corps	Dec 81	Sep 82	Reports	9	1	1	9	<b>10</b>	99
880	Final report	Corps	Apr 82	Sep 82	Water quality report	160	160	160	780	21	964
Total								-	1,874	110	1,984

#### WORK SCHEDULE

Stage I of the study, which began in October 1977, is concluded with this report. When approved, this report will serve as the basis for more extensive evaluation in Stages II and III. Stages II and III are expected to require a minimum of 4 1/2 years to complete.

Stage II will begin in October 1978 and require about 2½ years. Its product will be an interim preliminary report and environmental assessment presenting greater detail on the problems of the study area and alternatives. A major effort will be made to identify all possible alternative study components during the first year of Stage II. An alternatives report would be produced under the 8-year study schedule (see the table on page 178). Because of time limitations, components considered would be included in the Stage II preliminary feasibility report only under the shorter study schedules.

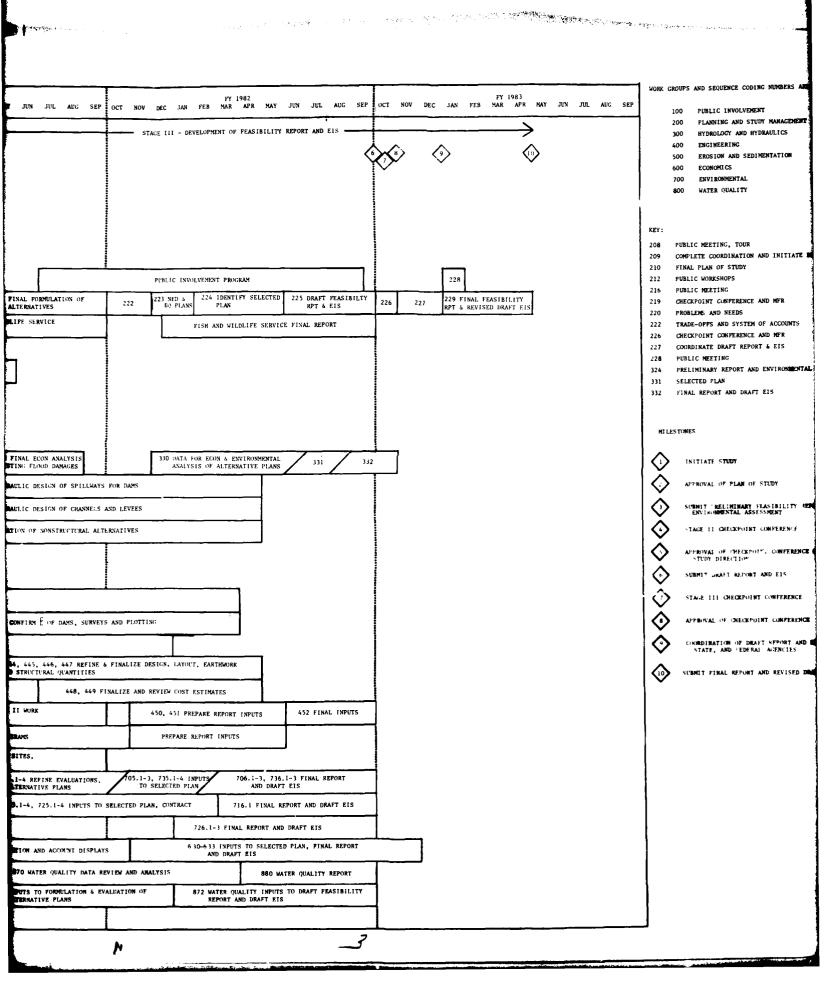
Stage III will involve coordination of various plan components and formulation of detailed alternatives to determine the NED, EQ, and selected plans. These plans will be presented in the final report and revised draft environmental impact statement.

The following study schedule shows the parallel relationship and sequencing of major work group items. Details on the work items can be found by sequence code numbers in the work group outlines in the previous section.

A detailed public involvement program will be conducted throughout the study. The various public forums are shown on the study schedule. The main objective of this program is to provide sufficient information to the various segments of the public and obtain input needed to formulate responsive, meaningful alternatives.

OCT NOV DEC JAN FEB MAR AP OCT NOV DEC JAN FEB MAR A APR MAY JUN JUL AUG SEP - STAGE I - PLAN OF STUDY PLANNING AND STUDY MANAGEMENT 202, 203 PLANNING ORIENTATION SESSIONS 204 ADVISORY 205 PROLIMINARY PROBLEMS, NEEDS, AND GENERAL ASTORIATIVE PLANS 211 FACILITATE INVENTORIES, STUDIES OF PROSS. & MEERS BY WORK ROUP 201 AUTHORIZATION, DEC 1975 206 CRITERIA, PROCEDURES, WORK GROUPS AND OUTLINE FOR PRELIMINARY DRAFT POS REVIEW OF EXISTING DATA, ALL WORK GROUPS 200 210 2 08 PUBLIC INVOLVEMENT PUBLIC INVOLVEMENT PROGRAM 213 FORGULATION OF ALTERNATIVE COMPON W/O PROJECT, MONSTRUCTURAL, STRUC FISH AND WILDLIFE SERVICE COORDINATION INTERIM PRELIMINARY SERVICE REPORT FISH AND WILDLIFE SERVICE PLANNING AID LETTER HYDRAULICS HYDROLOGY 301, 302 CONTRACT FOR AND COM 303 WORKING MAPS POR HYDROLOGIC MODEL To., ROUTING 30+, 307, 3 FREQUEN 312, 313 AND E 315 316, 311, 318, 321 PC FOR RECREATION AN ENGINEERING 401, 402 PREPARE FOR FIELD 404, 405 LAY OUT SOIL BORINGS. 406, 408, 410, PLOT SOIL 407, 409, 411, 4 EROSION AND SEDIMENTATION INVENTORY PRESENT ENVIROPMENTAL BIOLOGICAL 701.1-6 FISH AND WILDLIF 711.1-2 CULTURAL RESOURCES II CULTURAL. RECREATION 721.1-8 RECREATION MESOURE 73 731.1 SOCIAL PROFILE, CONTRACT SOCIAL ANALYSIS 601-610 PROBLEM IDENTIFICA-TION, DATA COLLECTION ECONOMIC WATER QUALLLY BOI WORKING MAPS FOR WATER QUALITY ANALYSIS 810 14

		STUD	Y SCHEDULE	
NOV DEC JAN 1935 MAR APR MAS IUN JUL ADG SEI	FY 1980 P OCT NOV DEC JAN FEB HAR APE	R MAY JUN JUL AUG SE		7Y 1981 NA APR MAY JUS JUL AUG SEP
STAGE 11 - DEVELOPME	NT OF-PRELIMINARY REPORT AND ENVIRONMENTAL	. ASSESSMENT —————	×	
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	**			
FACILITATE INTENDENCES, STUDIES OF PROBS. A NEEDS BY AUGS. ROLP FIEW OF ENISTING. 34A.				
WORK ORDERS	PUBLIC INVOLVEMENT PROGRAM		[26]	
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INTERIM PREIDMINARY FISH AND WILDLIFF SERVICE REPORT	<del> </del>	D WILDLIFF SERVICE REPORT	<del></del>	ALTERNATIVES FIRST AND WILDLIFE SERVICE FORE
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WERING MAPS FOR HG. US RIMOFF NOS. HYDROLOGIC MODEL C. ROTTING COLF.			325 REFINE AND VERSUY	HODELS
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SIN COMPULITY ALL DATA FOR LCONOMIC	ANALYSIS OF EXISTING FLOOD DAMAGES			376 FINAL ECON ANALYSIS EXISTING TEOOD DAMAGES
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(19, 320 GRADVETS AND	1. VEEST EVALUATION AND HYDRACTIC DESIGN		528 REPTNE AN	D VERTEY HYDRAULIC DESIGN OF CHANNELS A
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407, 409, GE, 415 ESTABLISH COE DAMS, LAVORE	S. SURVEYS AND NOTES		411,	435,440, 442 CONFIRM E OF DAMS, SURVEYE
	415, 416, 417 PREPARI FLOODPLATS DAMAGE	SOISE AND MAPS, DETERMINE SEL S. SCOUR AND CRITY	OBERT MORAGE REQUIREMENTS.	
418, 410, 420, 421, 422, 423, 474, OUT, FARTIMORK (MANITITES, GIR	. 425 STABILLTY, SEPPAGE & SEDIMENT, DESIGN ECTURE DESIGN, QUANTITIES, COORDINATION	, LAY		443, 444, 445, 446, 447 REFINE & AND STRUCTURAL QUANTITIES
	426, 427 INITIAL COST ESTIMATES			448, 449 %
	428, 429, 430 PRELIM RPT AND ENVIRONMENT (1933) 1, 713,1 2, 722,4, 723,1 2, 733.	NTAL ASSESSMENT INPUTS 1-2	411, 412 REVIEW AND EV 704.1, 711.1, 721.3-4	ALDATE STAGE IT WORK
INVENTORY PRESENT TATE 1	PRELOMINARY REPORT AND ENVIRONME	NEAL ASSESSMENT INPUTS	DEVILOP DAND	FREATMENT PROGRAMS
201.1-6 FISH AND ALIDERLY DIVENFORMES	70°,1-3 PLAN COMPONENTS AND EMPACE ANALYSES		CISE & WIEDLIFE HABITAT APPRAISALS AL APPRAISALS BY STRUCTURE SITES, C	
11:3-2 CULTURAL RESOURCES ENVENTORIES, CONTRACTS	712.1 PLAN COMPONENTS AND IMPACT ANALYSIS			724.1-4, 734.1-4 REFINE EVALUATIONS, ISPLAYS FOR ALTERNATIVE PLANS
721.1-8 RECREATION RESOURCES INVESTIGATES	722.1 3 PLAN COMPONENTS AND IMPACT ANALYSIS		1	715.1-4, 725.1-4 IMPUTS TO
1.1 SOCIAL PROFILE, CONTRACT 731.2 DISTITUTIONAL ANALYSIS, 1 COSTRACT 10 PROBLEM IDENTIFICA-	737,1-2 PEAN COMPONENTS AND IMPACT ANALYSIS	733.5 REVIEW AND EVALUATE PLACE 14 WHER		
TION, DATA COLLECTION	DAMAGES FOR INTERIS WILPORT	617-627 FORBILATION & EVALUATION OF PLANS	6.084 677 677 F	NY PLAN EVALUATION AND ACCOUNT DISPLAY
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	OF 810 860 950 MGH SAMPLING CONTRACT, SAMPLING AND ANALYSIS	·	<del></del>	R71 INPUTS TO FORMULATION & ST ALTERNATIVE PLANS
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#### STUDY COST ESTIMATE

The total study cost is estimated at \$7,373,000. This estimate allows for contingencies and administrative overhead in accomplishing the work. The following table is a summary of the study cost estimate and manpower requirements.

Summary of costs and manpower requirements

	<del>*</del>				Tota	1
	C	osts	Man-	years		Man-
Major work item	Corps	SCS	Corps	SCS	Costs	years
Public involvement	\$53,000	\$53,000	1.3	1.3	\$106,000	2
Planning and study management Economics(1)	590,000 (116,000)	635,000 (209,000)	13.2 (3.2)		1,225,000 (325,000)	27 <b>(</b> 9
Hydrology and hydraulics	1,060,000	504,000	25,5	15.4	1,564,000	40.
Engineering	1,644,000	1,640,000	34.6	37.3	3,284,000	71.9
Environmental	788,000	226,000	14.2	6.1	1,014,000	20.3
Erosion and sedimentation	-	140,000	-	3.7	140,000	3.7
Fish and Wild- life Service	40,000				40,000	
Total	4,175,000	3,198,000	88.8	78.5	7,373,000(2)	167.3

 <sup>(1)</sup> Economics subitem is included in planning and study management.
 (2) Includes \$1,338,000 for contracts (\$599,000 - Corps, \$739,000 - SCS).

The study cost estimate, schedule, and manpower requirements shown on the following table are based on needs identified by the work groups. The cost estimate and proposed study schedule exceed the fiscal year 1979 study funding levels and manpower capabilities of the Corps and SCS. Alternative funding levels and probable manpower capabilities were analyzed and are displayed in the tables on pages 177 and 178. The table on page 177 shows the study effort adjusted according to expected funding in fiscal year 1979. As a result, the study period is extended about 6 months. The table on page 178 displays annual funding and total manpower requirements on the basis of an 8-year study period. The staffing levels are those that could reasonably be attained. The table on page 179 is the summary of manpower requirements for study conditions shown in the tables on pages 176, 177, and 178.

	<b>k</b>	1	*	1	STACE 11	1			5413			1						
	202	8	Preliminar	~	report and envi	ronmental		70 390 71	Feasibility	report.	chid bilb	-5	May 83)					
					Study co	ot estimate	and manpowe	r requirem	nts		1							
		878		979		Fiscal year		.00	1080		861							
Study item	Corps	SCS	Corps	SCS	Corps	SCS	Corps	SCS		SCS	Corps	SUS	Corps	SCS	Combined	A S	SCS	Total
Public Involvement	\$3,000	\$ 3,000	\$5,000	\$5,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000 \$10,000 \$15,000	000,0		\$15,000	\$53,000	\$ 5.5,000	\$106,000	.:		2.6
Planning and Study Management																		
Economics Formulacion Condo management	000,1	2,000	30,000	30,000	27,000	45,000	45,000	000.04	25,000 4	000,44	15,030 30,000	26,000	206,000	209,000	325,000	3.5	2.5	9.2
Coordination and report	3,000	000,	22.000	20,000	22,000	20,000	25,000	22,000				15.000	116,000	104,000	220,000	·		; ;
Total	21,000	27,000	100,000	117,000	126,000	131,000	126,000	134,000		•		94,000	990,000	635,000	1,225,000	13.2	14.7	27.9
Hydrology and Hydraulics																		
Hydrology	\$,000	11,000	37,000	93,000	37,000	000,89	21,000	53,000			_	15,000	116,000	291,000	407,000	3.3	0.0	13.3
Hydraulica Water quality	900.	000	236,000 23,000	000.5	118,000(1)	000.4	93,000(1)	22,000 5,000	80,000 80,000	2,000	22,000	000	415,000 395,000 <sup>(1)</sup>	28,000 28,000	520,000 423,000	13.7 8.5	. 5	9.0
Coordination and report preparation	7,000	000',	26,000	10,000	33,000	10,000	30,000	10,000			_	000'9	1 14,000	20,000	184,000	,	,	ı
Total	22,000	21,000	272,000	152,000	324,000	152,000	222,000	93,000	160,000 5	53,000 6	000,00	33,000	000,000,1	204,000	1,564,000	23.5	15.4	6.04
Engineering		Š		•		•		•						•	;			
Topographic mapping		202,000 <sup>(2)</sup>	, , , , , , , , , ,	309,000(2)	_ `	, 114,000(2)		114,000 <sup>(2)</sup>	, 6				335 200 (3)	739,000 <sup>(2)</sup>	_	١;	4.0	4.0
Drilling and testing	, ,		90,000	000,04	120,000	000*07	150,000	000.04			_		204,000	130,000	634,000	5.5	, 1.9	13.2
Foundation design Geology	2,000 2,000	7 7 00 00 00	20,000 10,000	16,000	36,000	70,000	80,0% 10,000	70,000 22,000					345,000 58,000	227,000	572,000	12.4	9.6	21.0
	1,000	1,000	16,000	15,000	000	65,000	000,04	75,000					147,000	241,000	388,000	2,2	6.0	7.
COST SET SALES	١.	1	000	000,9	000	15,000	15,000	24,000			_	0	46,000	75,000	121,000	11	3.5	2.5
Utarting Coordination and report preparation	3,000	2,000	18,000	18,000	18,000	18,000	8,000 18,000	18,000	18,000	18,000	19,000	10,000	52,000 94,000	000, 38	178,000	1:s -	2°2 ,	0.4
Total	000'6	209,000	338,000	433,000	441,000	353,000	374,000	383,000	297,000 21	1000,612	185,000	43,000	1,644,000	000.079	3,284,000	34.6	37.3	11.9
Environmental																		
Biological Cultural	2,000	2,000	17,000(4)	23,000	17,000(4)	23,000	17,000(4)	23,000	10,000 2	23,000	10,000	13,000	80,000(4)	110,000	190,000(4)	2.6	6.1	6.7
Mecreation	1,000	000	46,000(5)		47,000	8,000	34,000	7,000				2,000	170,000(5)	30,000	200,000(5)	4.0	1.0	4.6
Coordination and prepara-	1,000	1,000	20,000		21,000	6,000	36,000	13,000			. ~	10,000	150,000	26,000	206,000	<b>;</b> ,	,	·
Total	11.00	000	148.000	43.000	249,000	15.000	180,000	50.700	120.000 5	51.000 7	27.000	28.700	788.000	226.000	1.014.000	14.2	;	20.3
				•	•	•								,			;	:

(1) Includes water quality contract, total \$74,000 (Corps).
(2) Contracts (\$65), total \$739,000.
(3) Includes auvey contract, total \$260,000 (Corps).
(4) Includes contracts, total 6826,000 (Corps).
(5) Includes contracts, total of \$26,000 (Corps).
(5) Includes contracts, total of \$26,000 (Corps).
(6) Agressments with 74th and Widdlife Sarvice (Corps).

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Preliminary report and environmental assessment (1 Aug 81) Feasibility report and E1S (1 Ort 82)
Study c at estimate and manpower requirements (based on FY 1979 budget limitarion) \* STAGE 1 \*

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					Study c.st	estinate a		requi rement	s (based on	FY 1979 b.	requirements (based on FY 1979 budget limitation)	1 Oct 82)					
						Fiscal vear	Cost estimate										
Study item	Corp.	1978 SCS	Corns	979 SCS	Corps	1980 SCS	Corps	\$25	19.5	19	1.45.5	\$2.55	KW)	C. bined	취.	Man-vents Times	1:
Public Involvement	\$3,000	\$3,000	\$5,000	\$5,000	\$10,060	\$10,000	\$10,000	\$10,000	\$10,000 3	\$10,000 310,000 \$15,000	0.0*51\$ 00	\$53,000	\$53,000	\$10,6,000	7	1.1	2.6
Planaing and Study Management																	
Economics		2,000	22,000	000***	27,000	45,000	26,000	45,930				116,000	209,000	325,000	3.2	6.0	7.6
Formulation	1,000	000	20,000	20,000	50,000	42,000	45,000	000.04	90.	000 07 LUU	36,000	206,000	183,000	389,000		, , ,	13.2
Coordination and report	20,00	200,101	200	20.00	99.	30.	8	30.				2001		200.	•	;	:
preparation	3,000	3,00	18,000	15,000	22,000	20 000	25,000	22,000	28,000	27,000 20,000	20,000	116,000	104,000	220,000	•	۱.	•
Total	21,000	27,000	80,000	000'66	126,000	131,000	126,000	134,000	136,000 14	1:2,000 101,000	00 102,000	290,000	635,000	1,225,000	13.2	14.7	27.9
Hydrology and Hydraulics																	
Hydrology	2,000	11,000	21,000	20,000	37,000		27,000	93,000					291,000	000* 207	3.3	10.0	13.3
Hydraulics	86	8,8	86.5	30°00	136,000(1)		78,000	35,000					135,000	220,000	5.7	9.0	9.6
Coordination and report	88	88	13,000	10,000	33,000	10,000	30.000	10.00	2000	10,000 22,000	000	134,000	90.05	184,000	} '	} '	? ,
preparation												1			ł	1	1
Total	22,000	21,000	121,000	95,000	324,000	152,000	228,000	143,000	205,000 6	60,000 130,000	33,000	1,060,000	504,000	1,564,000	25.5	15.4	40.9
Engineering																	
Topographic mapping		202,000 <sup>(2)</sup>	, ~	300,000 <sup>(2)</sup>		123,000 (2)		114,900 <sup>(2</sup>	•	,	•	,	739,000(2)	739,000 <sup>(2)</sup>	•	0.4	0.4
Surveys									20,000		٠	335,000(3)			2	,	3.1
Drilling and resting	, ,	, 8	20,000	000.07	184,000		150,000		80,000		89	504,000		634,000	9:		:
Geology	90,2	2,00	000	22,000	16,000		1,000			1 000 10,000	٠ ٠ د ۲	345,000		137,000	5	7	;
Structural design	1,000	1,000	13,000	15,000	40,000		40,000				000 15,000	147,000		386,000	5.2	6.9	7.1
Meal satate Cont sarinates			96	00.4	25,000	86.5	26,000	000	36.38	2 200		90,000	18,000	108,000	7.7	0.0	5.2
Drafting	1,000	1,000	2,000	000	2,000		000			2,000				72,000	:	2.5	.0
Coordination and report	3,000	2,000	18,000	16,000	18,000		16,000				00 12,000			178,000	•	,	
Total	8	800	8					100			:		000 073	100	;	;	۱
	3	000*607	37,000	422,000	243,000	367,000	000,064	000 5 95	310,000 21	000'861 nm'617	000,5	1.044,000	1,640,000	3.24,000		:	:
Environmental																	
Biological	8	86.	17.000(€)	23,000	17,000(4)	23,000	17,000 (4)	23,000	17,300	23,000 10,000	13,030	80,000	110,000	190,000(4)	, . ,	,	
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Summary of manpower requirements for study conditions displayed in the tables on pages 176, 177, and 178

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study	2	1.8	2.5	3.0	3.2	2.8	3.2	3.2	3.5	2.4	2.3	ı	ı	ı	ı	13.2	14.7	57.9
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Engineering	~	5.4	5.9	7.5	10.2	9.5	11,5	8.2	8.1	4.0	1.6	ı	ι	,	ı	34.6	37.3	71.9
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(1) Condition 1 - see table on page 176. Condition 2 - see table on page 177. Condition 3 - see table on page 178.

#### RECOMMENDATION

(To be added in final reconnaissance report.)

HARRY M. MAJOR FORREST T. GAY, III
State Conservationist Colonel, Corps of Engineers
Soil Conservation Service District Engineer

STUDY (PUBLIC LAW ST-635)
RECONNISSANCE STACE REPORT
(PLAN OF STUDY)

U.S. FISH AND WILDLIFE SERVICE
PLANNING AID LETTERS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERNATION SE VICE
AND
DEPARTMENT OF THE ANNY
ST. PAUL DISTRICT, CON'S OF ENGINEERS

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#### Item

LETTER FROM THE U.S. FISH AND WILDLIFE SERVICE, 12 APRIL 1978

LETTER FROM THE U.S. FISH AND WILDLIFE SERVICE, 28 AUGUST 1978



## United States Department of the Interior

FISH AND WILDLIFF SERVICE

IN REPLY REPER TO

St. Paul Field Office 538 Federal Building and U.S. Court House 316 North Robert Street St. Paul, Minnesota 55101

Colonel Forrest T. Gay, III
District Engineer
U. S. Army Corps of Engineers
St. Paul District
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

1 2 APR 1978

Dear Colonel Gay:

This letter pertains to the U.S. Fish and Wildlife Service's scope of work for the P.L. 87-639 Joint Study in the Upper Mississippi River Subbasin between the Corps of Engineers and the Soil Conservation Service.

It is the basic policy of the Fish and Wildlife Service to participate fully in all phases of the national water and related land development program, including those projects Federally permitted or assisted. The Fish and Wildlife Service insists that projects be planned, formulated, and implemented with full consideration for the protection, restoration and enhancement of fish and wildlife resources. Fish and Wildlife related values are public in nature. They are held in trust and managed for the people of the States and Nation by State and Federal Governments. Direction, authority and guidelines for involvement of the Fish and Wildlife Service and other Federal agencies in the protection of fish and wildlife resource values in connection with water resources development is provided in the following legislation:

- 1. Federal Water Project Recreation Act (16 U.S.C. 4601-12-4601-21; 79 Stat 213), as amended,
- 2. Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq; 30 Stat. 1151), as amended and supplemented,
- 3. Rivers and Harbors Act of June 20, 1899 (33 U.S.C. 401 et seq; 30 Stat. 1151), as amended and supplemented,
- 4. National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347; 83 Stat. 852),
- 5. Watershed Protection and Flood Prevention Act, (16 U.S.C. 1001-1009; 33 U.S.C. 7016; 68 Stat. 666), as amended,
- 6. Executive Order 11988 Floodplain Management,
- 7. Executive Order 11990 Protection of Wetlands, and the
- 8. Fish and Wildlife Coordination Act (16 U.S.C. 661-666cc; 48 Stat. 401), as amended.

The intent of the legislation indicated above is best summarized by the purpose of the Fish and Wildlife Coordination Act, Section 661, to recognize "the vital contribution of our wildlife resources to the Nation, the increased public interest and significance thereof due to expansion of our National economy and other factors, and to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs."

The Fish and Wildlife Service's responsibility for conserving the nation's natural resources insures that the Service will cooperate fully in planning for water and related land development projects to insure that the proposals:

- 1. are environmentally sound,
- 2. minimize harmful effects on fish and wildlife, their habitat and their uses, and
- 3. maximize enhancements of their resources and uses.

The Service's expertise will be made available through identifying and evaluating the resources affected in any given planning situation and through the evaluation of probable impacts of alternative developments on the resources. The probable impacts will be evaluated in terms of non-monetary measures of changes in quality and productivity of fish and wildlife habitat. The same measurements will form a basis and justification for recommending means to (a) prevent losses, (b) mitigate damages and/or (c) compensate for losses of habitat. The Fish and Wildlife Service's habitat evaluation procedures will be used to analyze terrestrial and aquatic habitat in the project area. This planning process will serve as a basis for multi-objective planning as called for in Principles and Standards. To implement this planning process the materials and data indicated below must be provided;

- 1. Current planning area maps and Color Infared aerial photo mosaics for evaluation and planning purposes. The scale of the aerial photograph mosaics must be equal to or greater than 4" to the mile. Aerial photo mosaics are necessary for areas affected directly and indirectly and for lands potentially to be considered for mitigation or compensation of adverse effects.
- 2. Land-use, economic and population information projections "without-a-project" based on reliable identified studies.
- 3. Data showing expected project-caused or induced changes in land and water use for the project area affected over the full planning period by selected target years and
- 4. Documentation of physical land resources (soil stability) and geological resources, culturally significant resources, areas of natural beauty, historical and archeological amenities, documented ecological resources and species threatened with extinction).

Please keep us abreast of your planning efforts.

Sincerely yours,

**Field Supervisor** 

cc: Mr. Harry M. Major
Soil Conservation Service
U.S. Department of Agriculture
200 U.S. Court House & Federal Building
316 North Robert Street
St. Paul, Minnesota 55101



### United States Department of the Interior

FISH AND WILDLIFF SERVICE

IN REPLY REPLE TO:

St. Paul Field Office, Ecological Services 538 Federal Building and U.S. Court House 316 North Robert Street St. Paul, Minnesota 55101

Colonel Forrest T. Gay, III
District Engineer
U.S. Army Corps of Engineers
St. Paul District
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

211 40 10 10

**Dear Colonel Gay:** 

This letter is provided to document U.S. Fish and Wildlife Service involvement in Stage I of The Upper Minnesota River Subbasin Implementation Study conducted by the Department of the Army and the Department of Agriculture as authorized by Congress under Public Law 87-639. The primary objective of this study is to further investigate and clarify alternatives for orderly development of water and related land resources of the study area to solve the flooding problems.

The estimated overall length of the study is 5 years with Stage I, Developing a Plan of Study, to be completed in FY 1978. During this Stage the Fish and Wildlife Service has been involved in the following areas of Plan of Study Development:

- 1. A representative of the U.S. Fish and Wildlife Service is a member of the Advisory Committee for the Implementation Study and the Fish and Wildlife Service has been represented at quarterly meetings held throughout FY 1978.
- 2. The U.S. Fish and Wildlife Service is represented on the Environmental Resources Work Group for the Implementation Study. This group developed needed Fish and Wildlife Investigations for project compliance with the intent of the National Environmental Policy Act of 1969 and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.)

In addition to the above, our letter of April 12, 1978 identified Fish and Wildlife Service interest and advised the Soil Conservation Service and the Corps of Engineers of guidelines and constraints that must be considered when investigating objectives addressed in the Plan of Study.

The draft preliminary Plan of Study developed by the Soil Conservation Service and the Corps of Engineers was reviewed and our review comments were submitted on May 26, 1978. These letters indicated our concerns with project planning and its emphasis on structural measures to solve flooding problems. It is the view of the FWS that nonstructural measures should be given equal consideration, especially in instances where fish and wildlife resources may be affected. In reviewing the POS several needs to improve fish and wildlife resources were indicated as being of concern to the Fish and Wildlife Service.

#### The most important of these are:

- 1. The need to preserve the remaining cold water streams in South Dakota and Minnesota that provide habitat for brook and brown trout.
- 2. The need to preserve wetland habitat in this prairie pothold region for use of waterfowl and other wildlife species.
- 3. The need to encourage private landowners to retain and improve their woodlots and windbreaks and to manage woodlands for their wildlife habitat values.
- 4. The need for improving wildlife habitat in the areas of agricultural productivity through implementation of programs emphasizing land treatment practices such as crop rotations, minimum tillage, critical area planting, farmstead and field management, woodland management, pasture management, and delayed mowing of herbaceous cover until after nesting season.

The involvement indicated above complies with the intent of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) which requires agencies to coordinate with the Department of Interior through the Fish and Wildlife Service to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water resource development programs.

In subsequent stages of the POS, Stages II and III planned for FY 1979 - FY 1982, the Fish and Wildlife Service will participate in planning to insure that final project plans:

1. are environmentally sound,

2. minimize harmful effect on fish and wildlife and their habitat and,

3. maximize enhancement of fish and wildlife resources and their use.

Please keep us abreast of your planning efforts.

Sincerely,

Richard F. Berry

Field Office Supervisor

cc: MN DNR, St. Paul, MN
SCS, St. Paul, MN
USFWS, Pierre, S. Dakota
Attn: Philip Laumeyer

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LETTERS OF ASSURANCE AND COORDINATION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AND
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS

#### APPENDIX B

### LETTERS OF ASSURANCE AND COORDINATION

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DEPARTIENT OF THE ARRY
St. Paul District, Corps of Engineers
1135 P.S. Post Office and Custom Rouse
St. Paul, Minnesots 55101

Soil Conservation Service 316 Conth Robert Street St. Paul, Minnesota 35171

TOSEINERS

13 April 1978

Fr. George Alexander, Jr.
Enjional Administrator, Region V
U.S. Environmental Protection Agency
230 South Bearborn Street
Chicago, Illinois 60604

Dear Mr. Alexanders

This is to advise you of a current Upper Minnesota River Subbasin Invlementation Study being conducted jointly by the Soil Conservation Service and the Corps of Engineers under the authorization of Public Law 37-639. The inclosed preliminary draft plan of study provides an ownrelew of the investigation. This preliminary draft is being reviewed by local study participants for comment on scope and content, particularly detailed studies, work schedule and costs. The preliminary draft will be modified to reflect their comments and mailed out as a draft plan of study at a later time for Pederal, State and local agency review and comments.

The Soil Conservation Service and Corps of Engineers would like to meet with representatives of the U.S. Environmental Protection Agency, Minnesota Follution Control Agency, and South Dakota Department of Environmental Protection to discuss specific mater quality issues associated with the ultimate implementation of a selected water and land resource development plan to achieve the study objectives listed on page 2 of the plan of study.

Specific issues and questions we would like to address include:

- a. Existing water quality standards for the subbasin tributaries. Do the tributaries now meet these standards? What water quality standards will the State astablish for the reservoir and the stress reaches downstroam of a dam? If water quality standards are not currently met for the basin tributaries, do you expect full compliance with standards after reservoir development?
- b. Do you have any specific concerns regarding the impacts of potential channel modifications on the assimilative capacity of streams? What parameters are of concern? Is any sampling, monitoring or modeling needed to determine

POMED-PD Mr. George Alexander, Jr.

the water quality impacts of potential channel modifications? If needed, what specific studies do you require and what level of detail is acceptable to your agency?

- c. That do the State agencies view as beneficial uses of the hasis tributaries? Is reservoir development compatible with these beneficial uses? Is stream channelization development compatible with these beneficial uses? Is the climination of cross-subbasin flow compatible with these beneficial uses? Are high and low flow diversion channel developments compatible with these beneficial uses? If any of these types of development result in violation of existing water quality standards of the tributaries, under what circumstances and conditions would the Environmental Protection Agency accept the State agency st
- (1) Variances in the water quality standards for parameters within a specific use classification?
  - (2) Changes in the use classification for a seement of the stream?
  - (3) Changes in the use classification for the entire stream?
- d. Would dry daw flood control reservoir type impoundments with shortterm detention times be considered to impose any significant downstream water quality problems? What minimum detention time would be considered sufficient to potentially impact on downstream water quality?
- e. Would anticipated sutrophication of a reservoir development result in unequivocal opposition of the Environmental Protection Agency to that project?
- f. Under what conditions, if any, would beneficial immacts of flood control, water quality, recreation, and fish and wildlife be sufficient to alter opposition of the Environmental Protection Agency and State agencies to the potential developments not fully complying with their water quality standards?
- g. Mould current state-of-the-art methods of mitigation or alimination of potential water problems downstream of a reservoir such as a multi-level outlet structure, seration of the reservoir to prevent thermal stratification, or any other methods and coordination of the reservoir operation plan be acceptable?
- h. The water quality monitoring program including the required parameters and frequency and duration of data collection. That physical, chemical, and biological parameters are used to determine whether a reservoir, channel modification or diversion is acceptable and meets the baneficial uses of a river?
- i. A discussion of any predictive models that should be included in the water quality studies to evaluate the parameters.

GCSED=TB

Mr. George Alexander, Jr.

- j. Specific items that should be included in the water maility report.
  What constitutes an adequate report and documentation?
- k. At what phases of project planning should (1) preliminary vater quality evaluation be made and reported based on available data and (2) detailed water quality data collection and analysis be conducted and reflected in the planning process and environmental impact statement?
  - 1. Any other related matters as deemed appropriate.

We expect that a 1-day meeting will be required to alequately aldress all of the above items. Accordingly, we have scheduled a meeting in room 1220 to the Corps of Engineers office for 9 a.m. on 24 April 1978. We are arranging a field trip following the meeting to commence that day or the following morning and run through Thursday, 27 April, with return to St. Paul on Friday, 28 April. We invite you to participate and will arrange transportation mends. Please confirm the number of representatives from your office who will participate in the field trip with either in Peter Pischer, Chief, Bydraulic Engineering & Foundation Materials Branch (612-725-7567), or Mr. Robert Northrup, Chief, General Investigations Section (612-725-7559).

Sincerely,

l Incl

HARRY H. HAJOR

State Conservationist

Soil Conservation Service

FOSHERT T. GAY, III Goloncl, Corps of Engineers District Engineer

Copy furnished: Mr. Keith L. Beseke Western District Office U.S. Environmental Protection Agency 7401 Lyndale Avenue South Minneapolis, Minnesota 55423

Identical letters to: (See attached list)

#### Identical letters to:

Ms. Sandra Gardebring
Executive Director
Minnesota Pollution Control Agency
1935 W. County Road B-2
Roseville, Minnesota 55113

Mr. John A. Green
Regional Administrator
Region VIII
U.S. Environmental Protection Agency
1860 Lincoln Street
Denver, Colorado 80203

Dr. Robert H. Hayls
President
South Dakota Department of Environmental
Protection
The State Capitol
Pierre, South Dakota 57501

Copy to: Mr. Jim Nelson
South Dakota Department of Environmental
Protection
Joe Foss Building
Pierre, South Dakota 57501

DEFINEDRE OF THE ARMY
St. Paul District, Corps of Factineers
1135 U.S. Post Office and Custom Rouse
St. Faul, Minnerota 55101

BETATHOR OF ACETOR TO Soil Conservation Cervice 310 forth Tebert Street Ot. Paul, Cincosote 55101

GCSFD=P8

19 April 1978

Mr. Ceorge Alexander, Jr. Reviousl Administrator, Region V U.S. Environmental Protection Aconcy 230 South Desphorn Street Chicago, Illinois 60004

Dear Mr. Alexanders

This supplements our letter of 13 April 1973 concerning the Upper Minnesota Giver Subbasia Implementation Study being conducted under Public Law 37-6 Pt.

Inclosed is additional information and an itinerary for the tour of the subbasin scheduled for 24-27 April 1973. If you have any questions on this information or the tour, please contact us. Mr. Pobert Northrup, Chief. General Investigations Section (612-725-7559) can provide additional details.

Sinceraly.

I Incl

HARRY II. MAJOR State Conservationist Soil Conservation Service PORREST T. GAY, III Colonel, Corps of Engineers District Engineer

Copy furnished:
Mr. Kaith L. Beseke
Vestern District Office
W.S. Environmental Protection Agency
7401 Lyndale Avenue South
Minneapolis, Minnesota 55423

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1860 Lincoln Street
Denver, Colorado 80203

Dr. Robert H. Hayls
President
South Dakota Department of Environmental
Protection
The State Capitol
Pierre, South Dakota 57501

Copy to:

Mr. Jim Nelson Assistant Chief, Water Division South Dakota Department of Environmental Protection Joe Foss Bldg. Pierre, South Dakota 57501

## UPPER MINNESOTA RIVER SUBBASIN IMPLEMENTATION PROJECT CORPS OF ENGINEERS AND SOIL CONSERVATION SERVICE

#### WATER QUALITY ISSUES MEETING

#### AND

#### TOUR OF STUDY AREA

#### ITINERARY

\*Tour Guide Host Subject Time and Place Date Coffee and rolls. 8:30 a.m., PEDC Training Mon., 24 Apr 78 room, 6th floor, Post Office Bldg., 180 E. Kellogg Blvd. 9:00-12:00 a.m., PEDC Study Area Water Quality Issues Meeting. Training room. Board Tour bus, Enroute 12:30-1:00 p.m., Front Post to Milbank, South Post Office Building. Dakota. Confirm Motel Reser-5:30 p.m., at Lantern and vations, Milbank, South Manor Motels. (both 605-Dakota. 432-4591) Fellowship and Dinner 6:00 p.m., at Lantern Motel joined by Messrs. Restaurant (605-432-9871) Willard Pearson, Walter Matz, Lyle Hanson and Wives, representing the Area II Action Committee. Tues., 25 Apr 78 Walter Matz & Tour of Yellow Bank R. 8:30 Board tour bus with Odell Greene Basin, South Dakota and luggage at motels. Jerry Siegel North Fork Lac Oui Parle River Basin, Minnesota. 1. Visit Corps Big Stone Lake-Whetstone River Project South Dakota-Minnesota. 12:00 picnic or box lunch 2. Visit, via tractor and arranged by Odell Greene trailer, a crossover flooding breakout site between Yellow Bank and Lac Oui Parle Basin. & small and major reservoir sites on Yellow Bank River. Willard Pearson 3. Visit small & major reservoir sites & other points of interest along Lost Creek and West Branch North Fork Lac Qui Parle River. 5:00 p.m., at Monti (269-8889) & Fiesta (269-8896) Motels. Confirm Motel reservations Montevideo, Minnesota. Fellowship and Dinner Restaurants near Motels. Individual arrangement.

|--|

#### Tour Guide Host Subject

#### Time & Place

Wed., 26 Apr 78

Willis Beecher

Willard Pearson Tour of North and South 8:30 Board tour bus with Fork Lac Qui Parle River luggage at Motels. Basins and Yellow Medicine River Basin.

- 1. Visit major reservoir site on Florida Creek, N. Fork Lac Qui Parle River.
- 2. Visit RC&D reservoir site on Lazarus Creek South Fork Lac Qui Parle River.
- 3. Visit PL 566 reservoir site on Conby Creek, South Fork Lac Qui Parle River.
- 4. Visit a crossover flooding breakout site between the Lac Qui Parle and Yellow Medicine River basins.
- 5. Visit major reservoir site on South Fork Lac Qui Parle River south of Conby. 6. Weber dam between Florida Creek and Lazarus Creek. 12:00 Lunch at Restaurant.

John Boulton

Tour of North and South Fork Yellow Medicine River. 1:00 p.m.

- 1. Visit crossover flooding breakout site near Porter.
- 2. Visit small and major reservoir sites on North Fork Yellow Medicine near Hendricks, Minnesota.
- 3. Visit small and major reservoir sites on South Fork Yellow Medicine River.

Wed., 26 Apr 78 John Boulton

Confirm Motel Reservations 5:00 p.m. at Ramada Inn. Marshall, Minnesota

Fellowship and Dinner 6:00 p.m. at Ramada Inn. Joined by Messrs. Willard Pearson and John Boulton.

Slide Presentation 7:30 p.m. at Southwest of Crossover Flooding State College, Marshall, in the Basins visited. Minnesota Willard Pearson, John Boulton, Hal Burnham & Tom Hallbeck

.nurs., 27 Apr 78 Hal Burnham, Roy Syverson

Tour of Redwood and Cotton- 8:30 Board tour bus. Torgny Anderson wood River Basins.

#### Tour Guide Host Subject

#### Time and Place

Inurs. 27 Apr 78 Hal Burnham
Torgny Anderson
Roy Syverson

- 1. Visit major reservoir site below Lake Benton on Dead Coon Creek NW of Russell.
- 2. Visit major reservoir site downstream of wildlife area on Redwood River south of Russell.
- 3. Visit major reservoir forested site on Cotton-wood River.
- 4. Visit major reservoir site under construction with State funds administered by the S&WC Board at Walnut Grove.

12:00 p.m., lunch at restaurant to be determined

Board tour bus Enroute 4:00; .m., New Ulm vicinity to Minneapolis, St. Paul, Minnesota.

Arrive Minneapolis, St. 6:30 p.m. Paul, Minnesota Airport drop-off, if needed.

#### \* Tour Guide Hosts:

Walter Matz, Watershed Manager, Lac Qui Parle-Yellow Bank (LqP-YB) Watershed District Odell Greene, District Conservationist, Milbank Field Office, 592 Federal Building, Milbank, South Dakota

Willard Pearson, President, LqP-YB Watershed District; Chairman, Area II Action Committee Jerry Siegel, Manager, East Dakota Conservancy District; member Area II Action Committee Lyle Hanson, Watershed Manager, LqP-YB Watershed District

Willis Beecher, Watershed Manager, LqP-YB Watershed District

John Boulton, President, Yellow Medicine River Watershed District; member of Area II Action Committee

Hal Burnham, Engineer, State Soil & Water Conservation Board, Ivanhoe, Minnesota Tom Hallbeck, University of Minnesota Extension Service

Torgny Anderson, Retired Chairman Lyon County Board; Member of Area II Action Committee Roy Syverson, Chairman, Redwood County Board; Member of Area II Action Committee

## UPPER MINNESOTA RIVER SUBBASIN IMPLEMENTATION STUDY CORPS OF ENGINEERS AND SOIL CONSERVATION SERVICE TOUR OF STUDY AREA - 24-27 APRIL 1978

#### TOUR INFORMATION

- 1. A schedule for the water quality issues meeting and tour is attached.
- 2. Much effort has been made to insure that the tour will be as informative as possible. Local sponsors will serve as hosts.
- 3. Additional copies of the draft Plan of Study have been produced. Each participant will receive a personal copy. You may want to make notes in your copy. A packet of information is also being assembled for you.
- 4. About 25 to 35 persons are expected for the tour. A 48-passenger school bus will be used for transportation. Block reservations for lodging have been made for Monday, Tuesday, and Wednesday. Room rates are about \$15 for Monday and Tuesday and \$20 for Wednesday.
- 5. We will leave St. Paul about 1:00 p.m. on Monday, April 24 and arrive at Milbank, South Dakota, before a scheduled dinner at 6:00 p.m. No program is planned during the 4- to 5-hour trip. We encourage you to become acquainted with others on the tour (we are going to be rather close together for the week). You might like to bring a guitar, cards, reading materials, swimming suits, cameras, etc.
- 6. We will make a number of stops each day on the tour. Bring clothing suitable for outdoors; rain gear may be desirable. You may wish to walk over some of the areas visited (structure sites, overflow areas, etc.). Local land owners will point out damage areas, frequency of flooding, etc., along the tour route.
- 7. We will leave New Ulm at 4:00 p.m. on Thursday, April 27, for the return to St. Paul.

Attendance List Study Area Tour, Tuesday, 25 April 1978

	Area Tour, Tuesday	
Name	Address	Organization
Linda Lensing	Canby, MN	Secretary, Lac qui Parle-Yellow Bank Watershed District
Jerry F. Siegel	Brookings, SD	Manager, East Dakota Conserva- tion Subdistrict
Willard Pearson	Dawson, MN	Lac qui Parle-Yellow Bank Watershed District
Walter Maatz	Bellingham, MN	Lac qui Parle-Yellow Bank Watershed District
Gloria Pearson	Dawson, MN	
Ellsworth Smogard	Madison, MN	State Representative, District 20A
Milford Anderson	La Bolt, SD	East Dakota Conservation Subdistrict
Lyle Hanson	Madison, MN	Lac qui Parle-Yellow Bank Watershed District
Glen Anderson	Bellingham, MN	State Representative, District 13B
Odell Greene	Milbank, SD	District Conservationist, Soil Conservation Service
Harley Svarvati	Milbank, SD	Technician, Soil Conservation Service
Norman Larson	Worthington, MN	Representing Representative Richard Nolan
Willie Beecher	Canby, MN	Lac qui Parle-Yellow Bank Watershed District
John J. Gundrison	Clarkfield, MN	District Conservationist, Soil Conservation Service
Kenneth Helgeson		Yellow Medicine River Watershed
Ed Traen	Cottonwood, MN	Yellow Medicine River Watershed
Keith Roble	Marshall, MN	Engineer, Soil Conservation Service
Melvin J. Niehaus	Ivanhoe, MN	District Conservationist, Soil Conservation Service
John Boulton	Porter, MN	Yellow Medicine River Watershed
Vernon Maas	Canby, MN	City Administrator, Canby
Tom Fischer	Marshall, MN	Soil Conservation Service
Carl Hauschild		Lincoln County Commission
George Holcomb	Marshall, MN	Agricultural Extension Service, Marshall State University
Tom Hallbeck	Marshall, MN	Agricultural Extension Service, Marshall State University
Hal Barnham	Ivanhoe, MN	
Jim Nichols	Lake Benton, MN	State Senator

## STATE PLANNING BUREAU SOUTH

State Capitol Pierre, South Dakota 57501 605/224-2661 773-3661

State Capitol Dakota 57501 605/224-2661 Executive Management

April 28, 1978

Mr. Robert Northrup, Chief General Investigation Section, Planning Board U.S. Army Corp of Engineers Post Office Building and Custom House St. Paul, Minnesota 55101

Dear Mr. Northrup:

As I believe you are aware, Mr. Stan Kummer of your office has been scheduled to meet with the South Dakota Natural Resources Cabinet Subgroup on Wednesday, May 3, 1978, for the purpose of making a presentation regarding the purpose and status of the Upper Minnesota River Sub-Basin Implementation Project. The meeting will be held at 1:30 p.m. in the Game, Fish and Parks commission room, Sigrud Anderson State Office Building.

The Natural Resources Cabinet Subgroup is the forum through which major policy issues pertaining to natural resources are reviewed and coordinated. The Subgroup is chaired by Dr. Allyn Lockner, Secretary of the South Dakota Department of Environmental Protection. Other members of the Subgroup are the departments of Natural Resources Development, Game, Fish and Parks, Agriculture, Transportation and School and Public Lands. The Bureaus of Finance and Management and State Planning, as well as the Office of Energy Policy, also participate as Subgroup members.

A copy of the agenda for the May 3rd Subgroup meeting is enclosed for your reference. Please contact me if you should have any additional questions. We look forward to Mr. Kummer's presentation.

Cordially,

Scott D. McGregor Deputy Commissioner

cc: Mr. Stan Kummer

April 28, 1978

#### **MEMORANDUM**

TO: Natural Resources Cabinet Subgroup

FROM: Scott D. McGregor

RE: Agenda for May 3, 1978, Subgroup Meeting

The next meeting of the Natural Resources Cabinet Subgroup will be held on Wednesday, May 3, 1978 at 1:30 p.m. in the Game, Fish and Parks Conference Room, Sigrud Anderson Office Building. Items to be considered at that time include:

- 1. WESTPO update (Lockner)
  - a. State Management of Resource Scarcity and Hazards
  - b. WESTPO · Committee on Natural Resources
- Upper Minnesota River Subbasin Implementation Project,
   P.L. 87-639 (Stan Kummer, Corps of Engineers)
- 3. Water Development Alternatives, Vol. II State Water Plan (Butler)
- 4. Natural Resources Organizational Study (Garry)
- High Plains Project; develop recommendations for the Governor (Lockner)
- Department of Energy and Utility Regulation; develop recommendations for the Governor (Lockner, Van Loan)
- Garrison EIS; develop recommendations for the Governor (Lockner)
- 8. Mine Safety Inspections (Griffiths)
- 9, Other
  - a.
  - b.

# Department of Environmental Protection

Pierre, South Dakota 57501 Phone (605) 224-3351

April 28, 1978

Don Hartman St. Paul District, Corps of Engineers 1135 U.S. Post Office and Custom House St. Paul, Minnesota 55101

Dear Don:

Due to prior commitments, no one from our Department was able to attend a tour of the proposed Upper Minnesota River Sub-basin Implementation Project sites in South Dakota. However, other departments in South Dakota in addition to our own should be involved with the project. The Governor's Natural Resources Sub-Cabinet can serve as a forum to meet and gain input from the concerned Departments. A mailing list of members is included. I would appreciate it if someone from the Corps of Engineers and the Soil Conservation Service familiar with the Preliminary Draft could come and give a presentation and answer questions on the project. Prior to the meeting it would be desirable if a brief paper summarizing the project could be given to the members to increase their participation. If arrangements can be made for such a meeting, please contact Ben Orsbon, Bureau of Planning, State Capitol, Pierre, South Dakota 57501, phone (605) 773-3661 and myself. Ben is in charge of the agenda for the Sub-Cabinet.

Sincerely,

Leland Baron

Environmental Analyst III Office of Water Quality

Mand Garon

cc: Harry M. Major

State Conservationist Soil Conservation Service 316 North Robert Street St. Paul, Minnesota 55101

Forrest T. Gay, III
Colonel, Corps of Engineers
St. Paul District Engineer
11135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

A4/16

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B-14

#### Natural Resources Sub-Cabinet

Allyn O. Lockner, Secretary (Chairman of Sub-Committee) S.D. Department of Environmental Protection Foss Building Pierre, South Dakota 57501

Vern Butler, Secretary
Dept. of Natural Resource Development
Foss Building
Pierre, South Dakota 57501

Richard Garry, Commissioner Bureau of Finance and Management State Capitol Pierre, South Dakota 57501

Albert Griffiths, Director Division of Conservation Anderson Building Pierre, South Dakota 57501

George D. Kane, Commissioner
Department of School and Public Lands
State Capitol
Pierre, South Dakota 57501

Steve R. Merrick, Commissioner Bureau of Planning State Capitol Pierre, South Dakota 57501

Jack Merwin, Secretary Department of Game, Fish & Parks Anderson Building Pierre, South Dakota 5750)

James Van Loan, Director Office of Energy Policy Foss Building Pierre, South Dakota 57501

B5/01

## Department of Environmental Protection

Pierre, South Dakota 57501 Phone (605) 224-3351

May 10, 1978

Col. Forrest T. Gay, III
District Engineer
U.S. Army Corp of Engineers
St. Paul District
Room 1222
P.O. and Custom House
180 East Kellogg Blvd.
St. Paul, Minnesota 55101

Dear Col. Gay:

On May 3, 1978, the Natural Resources Sub-cabinet designated Mr. Albert Griffiths as the contact person in the Executive Branch of South Dakota State Government for the Upper Minnesota River Sub-Basin Implementation Study under P.L. 87-639. All communications from the Executive Branch of State Government regarding this study will be channeled through Mr. Griffiths, and we respectfully request that all communications from Federal, State and local agencies in Minnesota to South Dakota State Government be channeled through him. Mr. Griffiths' title and address is Director, Conservation Division, South Dakota Department of Agriculture, Anderson Building, Pierre, South Dakota. His telephone is (605) 773-3258. Thank you.

Sincerely,

Department of Environmental Protection

cc: Richard F. Kneip, Governor
State of South Dakota
Mr. Albert Griffiths, Director, Division of Conservation
S.D. Dept. of Agriculture
Ben Orsbon, Executive Policy Aide
Bureau of Planning
Natural Resources Sub-cabinet

B5/07



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DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

DEPARTMENT OF AGRICULTURE Soil Conservation Service 316 North Robert Street St. Paul, Minnesota 55101

15 May 1978

Mr. George Alexander, Jr.
Regional Administrator, Region V
U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

ATTN: Mr. Ronald Mustard

#### Dear Mr. Alexander:

Our letter of 13 April 1978 advised you of the current Minnesota River subbasin implementation study being conducted jointly by the Soil Conservation Service and the Corps of Engineers under authorization of Public Law 87-639. We understand that the lead time was too short for you to respond to our invitation to attend a meeting to discuss specific water quality issues. The South Daketa Department of Environmental Protection also was not able to send a representative to the meeting.

This confirms our recent contact with Mr. William Frans of your office to set up another meeting with the same parties on 21 June 1978 at 9 a.m. in room 1220 of the Corps of Engineers office. We have also confirmed the meeting date with Mr. Lanny Reissig, Minnesota Pollution Control Agency, and Mr. Albert Griffiths, Division of Conservation, South Dakota.

Specific issues and questions we would like to address at the meeting are listed on inclosure 1. In April we met with representatives of the Minnesota Pollution Control Agency to discuss these points. Inclosure 2 states the Corps of Engineers-Soil Conservation Service position on the issues. For your convenience we are furnishing an additional copy of the draft plan of study which provides an overview of the investigation.

Mr. William Gaise, Environmental Protection Agency, Region VIII, has advised us that studies of the entire upper Minnesota River basin including the Yellow Bank River in South Dakota, usually under the jurisdiction of Region VIII, should be coordinated with your office.

#### Mr. George Alexander, Jr.

We trust that participation of your water quality experts will resolve issues early in the study and help to assure formulation of acceptable flood damage reduction plans for management of the water and related resources in the basin.

Sincerely,

State Conservationist

Boil Conservation Service

FORREST T. GAY, III Colonel, Corps of Engineers

District Engineer

3 Incl As stated

## UPPER MINNESOTA RIVER SUBBASIN IMPLEMENTATION STUDY Public Law 87-639

#### WATER QUALITY ISSUES

- a. Existing water quality standards for the subbasin tributaries. Do the tributaries now meet these standards? What water quality standards will the State establish for the reservoir and the stream reaches downstream of a dam? If water quality standards are not currently met for the basin tributaries, do you expect full compliance with standards after reservoir development?
- b. Do you have any specific concerns regarding the impacts of potential channel modifications on the assimilative capacity of streams? What parameters are of concern? Is any sampling, monitoring, or modeling needed to determine the water quality impacts of potential channel modifications? If needed, what specific studies do you require and what level of detail is acceptable to your agency?
- c. What do the State agencies view as beneficial uses of the basin tributaries? Is reservoir development compatible with these beneficial uses? Is stream channelization development compatible with these beneficial uses? Is the elimination of cross-subbasin flow compatible with these beneficial uses? Are high- and low-flow diversion channel developments compatible with these beneficial uses? If any of these types of development result in violation of existing water quality standards of the tributaries, under what circumstances and conditions would the Environmental Protection Agency accept the State agency's:
- (1) Variances in the water quality standards for parameters within a specific use classification?
  - (2) Changes in the use classification for a segment of the stream?
  - (3) Changes in the use classification for the entire stream?
- d. Would dry dam flood control reservoir type impoundments with short-term detention times be considered to impose any significant downstream water quality problems? What minimum detention time would be considered sufficient to potentially impact on downstream water quality?
- e. Would anticipated eutrophication of a reservoir development result in unequivocal opposition of the Environmental Protection Agency to that project?
- f. Under what conditions, if any, would beneficial impacts of flood control, water quality, recreation, and fish and wildlife be sufficient to alter opposition of the Environmental Protection Agency and State agencies to the potential developments not fully complying with their water quality standards?

- g. Would current state-of-the- art methods of mitigation or elimination of potential water problems downstream of a reservoir such as a multilevel outlet structure, aeration of the reservoir to prevent thermal stratification, or any other methods and coordination of the reservoir operation plan be acceptable?
- h. The water quality monitoring program including the required parameters and frequency and duration of data collection. What physical, chemical, and biological parameters are used to determine whether a reservoir, channel modification, or diversion is acceptable and meets the beneficial uses of a river?
- i. A discussion of any predictive models that should be included in the water quality studies to evaluate the parameters.
- j. Specific items that should be included in the water quality report. What constitutes an adequate report and documentation?
- k. At what phases of project planning should (1) preliminary water quality evaluation be made and reported based on available data and (2) detailed water quality data collection and analysis be conducted and reflected in the planning process and environmental impact statement?
  - 1. Any other related matters as deemed appropriate.

## WORK SHEET Specific Issues and Questions

a.

- (1) Existing water quality: General classification 2C, 3b basinwide except for some segments in the Redwood Basin classified as trout streams. Those not named are 2B.
- (2) Do tributaries meet standards? Major problems in Lac qui Parle and Yellow Medicine basins are violations of coliform and turbidity standards and elevated levels of nitrates and TSS. Nonpoint sources are significant and water quality standards cannot be expected to be maintained until nonpoint sources are controlled.

Monitored reaches of the Cottonwood are characterized by high levels of fecal coliform, turbidity, nutrients, and particulate matter. While noncompliant point sources contribute, the major source of pollution is probably nonpoint in the Cottonwood basin. Water quality of the Redwood is good. No data available for the Yellow Bank.

- (3) Water quality standards to be established: One of the points to establish is whether these intermittent streams are to be classified as Effluent Limited Segments or Water Quality Segments. Nonpoint sources of pollution are expected to be reduced because of the proposed SCS land treatment program.
- (4) Full compliance with standards after reservoir development: Group discussion.

ъ.

- (1) Impact of potential channel modifications on assimilative capacity: None of these intermittent streams have any assimilative capacity for a continuous loading.
- (2) Parameters of concern: Change in water temperature is thought to be the major parameter. We have done some modeling of temperature differences in regard to other channel modification projects.
- (3) Sampling, monitoring, modeling: We propose no sampling or monitoring for channel modifications. Could do some temperature modeling.
  - (4) Specific studies and level of detail: Group discussion.

Incl 2

c.

(1) Beneficial uses and variance in water quality standards and use classifications: In general, we anticipate that reservoirs would improve water quality by trapping of sediments and reducing downstream channel scour. Also, slower release rates would raise base flow conditions in some instances.

d.

(1) Would dry dams cause any significant downstream water quality problems: We do not anticipate any problems. Information from University of Minnesota (Shapiro) is that detention times of less than 10 days would have no effect on water quality.

e.

(1) Eutrophication: All of the reservoirs are expected to be eutrophic because of nature of soils, land use, and nutrient rich low base flow levels.

f.

(1) Position of EPA and State agencies if potential developments do not fully comply with water quality standards: No comment.

g.

(1) Current state-of-the-art methods for mitigating downstream water quality problems: The various methods such as aeration or multilevel outlet structures appear to be generally beneficial, and all have been used.

h.

(1) Water quality monitoring program: We propose to sample existing impoundments thought to be similar and representative to the proposed reservoirs. Samples would be taken during spring, summer, and fall at various depths in each pool. Standard parameters would be taken.

i.

(1) Predictive models: For dry dams or extremely shallow impoundments, we know of no predictive models. For the deeper (30 feet or more) dams the Corps has a predictive model. We do not propose to use any predictive models for this study.

WORK SHEET - Sperific Issues and Questions

j.

(1) Adequate report and documentation: The report will document all water quality sampling data and land uses upstream of each reservoir. This will also include all data on existing reservoirs which will be used to predict water quality in the proposed impoundments. The report will show all rationale used in predicting water quality conditions. We do not plan to investigate water quality conditions downstream to the Minnesota River.

RIVER BASIN	: DRAINAGE AREA	FLOW CPS	8		RUNOFF	71.00	FLOW DURATION	LOW PLOW CPS	ON CPS	USGS WATER QUALITY DATA
	Sq. M1.	Max.	Min.	AVS.	In./Yr.	Discharge cfs	Discharge Discharge Equal	7-Day	10-Year	
YELLOW BANK RIVER near Odesas, MN	398	6,970	0	56.9	1.94	1.0	91.3 48.2	.1		USGS currently taking specific conductance, temperature & sediment.
LAK QUI PARLE RIVER . near Lac Qui Parle, MN	983	29,400	0	119	1.64	13.0	86.6 52.3		r.	
SOUTH BRANCH YELLOW MEDICINE at Minneota, MN	111	4,430	0	20.3	2.48	1.70	81.3 53.2		,	
YELLOW MEDICINE RIVER near Granite Falls, MN	653	17,200	0	102	2.12	2.20 12.0	91.0 52.9		4.	
REDWOOD RIVER at Marshall, MN	307	5, 590	0	45.1	1.99	6.10	91.9		۲.	
REDWOOD RIVER near Redwood Falls, MN	697	19,700	0	98.8	1.92	1.50	92.3 51.0		e.	4.
COTTONWOOD RIVER near New Ulm, MN	1,280	28,700	ļ.	267	2.83	10.0 51.0	90.5 51.6		2.5	USGS Water Quality discontinued 1976

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesots 55101

DEPARTMENT OF AGRICULTURE Soil Conservation Service 316 North Robert Street St. Paul, Minnesota 55101

15 May 1978

Ms. Sandra Gardebring
Executive Director
Minnesota Pollution Control Agency
1935 West County Road B-2
Roseville, Minnesota 55113

Dear Ms. Gardebring:

Our letter of 13 April 1978 advised you of the current Minnesota River subbasin implementation study being conducted jointly by the Soil Conservation Service and the Corps of Engineers under authorization of Public Law 87-639.

In April we met with representatives of your office to discuss water quality issues associated with the study. The South Dakota Department of Environmental Protection and the U.S. Environmental Protection Agency were unable to send representatives to the meeting. Thus, we have set up another meeting with the same parties on 21 June 1978 at 9 a.m. in room 1220 of the Corps of Engineers office. We confirmed the meeting date with Mr. Lanny Paissig of your office, Mr. William Franz of the U.S. Environmental Protection Agency, and Mr. Albert Griffiths, Division of Conservation, South Dakota.

Specific issues and questions we would like to address at the meeting are listed on inclosure 1. Inclosure 2 states the Corps of Engineers-Soil Conservation Service position on the issues. For your convenience we are furnishing an additional copy of the draft plan of study which provides an overview of the investigation.

We trust that participation of your water quality experts will resolve issues early in the study and help to assure formulation of acceptable flood damage reduction plans for management of the water and related resources

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Sincerely,

HARRY M. HAJOR State Conservationist

Seil Conservation Service

PORREST T. GAY, III Colonel, Corps of Engineers District Engineer

3 Incl As stated

Copy furnished:
Mr. Lanny Peissig
Water Onality Division
Minnesota Pollution Control Agency
Roseville, Minn. 55113

St. Paul District, Corps of Engineers 1135 U.S. Poet Office & Custom House St. Paul, Minnesota 55101 DEPARTMENT OF AGRICULTURE Soil Conservation Service 316 North Robert Street St. Feel, Minnesota 55101

15 Nay 1978

Mr. Albert Griffiths Director Division of Conservation Anderson Building Pierre, South Dakota 57501

Dear Mr. Griffithm:

We are writing in regard to the current Minnesota River subbasin implementation study being conducted jointly by the Soil Conservation Service and the Corps of Engineers under authorization of Public Law 87-639. We scheduled a meeting in April to discuss water quality issues, but the South Dakota Department of Environmental Protection and the U.S. Environmental Protection Agency were unable to send representatives to the meeting.

This confirms our recent contact with you to set up enother meeting with the same parties on 21 June 1978 at 9 a.m. in room 1220 of the Corps of Engineers office. We have also confirmed the meeting date with Mr. William France, U.S. Environmental Protection Agency, and Mr. Lenny Peissig, Minnesots Pollution Control Agency.

Specific issues and questions we would like to address at the meeting are listed on inclosure 1. In April we not with representatives of the Minnesota Pollution Control Agency to discuse these points. Inclosure 2 states the Corps of Engineers-Soil Conservation Service position on the issues. For your convenience we are furnishing an additional copy of the draft plan of study which provides an overview of the investigation.

We trust that participation of your vater quality experts will resolve issues early in the study and help to assure formulation of acceptable flood damage reduction plant for management of the water and related resources in the bears.

•

RARRY N. NAJOR

State Conservationist Soil Conservation Service Sincerely,

FORREST T. GAY, III Colonal, Corps of Bagineers District Engineer

3 Incl As stated

Copy furnished:

Dr. Allys Lookner, Secretary, South Dahota Dept of Environmental Protection Pierre, South Dakota



#### ULATED STATES UNVIRORMENTAL PROTECTION AGENCY REGION V

230 SOUTH DEART ORN ST. CHICAGO, ILLINOIS 60604

## JUN 2 0 1978

Colonel Forrest T. Gay, III

District Engineer

U.S. Army Engineer District, St. Paul

1135 U.S. Post Office and Custom House

St. Paul, Minnesota 55101

Dear Colonel Gay:

I appreciate the letters of April 13, 1978 and May 15, 1978, signed by you and Mr. Harry M. Major of the Soil Conservation Service, in regard to the proposed flood control program for the Minnesota River Basin, which is being coordinated with the Soil Conservation Service. The two letters requested certain information and our views on some aspects of the project.

We have addressed these questions in our correspondence regarding the proposed Twin Talley Reservoir project. I see no need at this time to reiterate the position of this Agency in regard to water quality. The water quality studies should ultimately determine how the project will affect water quality standards and whether or not the predicted water quality problems can be resolved.

To facilitate a discussion and begin the studies for this project, a meeting has been arranged in your offices on June 21, 1978, at 9:00 A.M. Members of my staff will be in attendance and will assist you in formulating the water quality studies.

I appreciate your requesting our input at this early date. If I can be of any further assistance, please contact mc again.

Sincerety yours,

Valdus V. Adamkus

Acting Regional Administrator



## National Wildlife Federation

1412 16TH ST., N.W., WASHINGTON, D.C. 20036

Phone: 202-483-1550

1825 Nevada Ave. S. Minneapolis - 55426 June 22, 1978

Mr. L.K. Lappegaard Soil Conservation Service 316 N. Robert Street St. Paul. Minn. 55101

Dear Mr. Lappegaard:

I would appreciate receiving all pertinent information, including the draft project report, on the Upper Minnesota River Subbasin Implementation Project.

Please send this information to the Minneapolis address in the upper right hand part of this page.

I would also appreciate it if you'd send duplicate copies of the same information to the following:

Roger Pries, President S.D. Wildlife Federation 812 N. Monroe Pierre, S.D. 57501

Gordon Meyer, President, MCF 735 E. Crystal Lake Road Burnsville, Minn. 55337

Dr. Keith Harmon, Field Repr. Wildlife Management Institute Rt. 1, Box 122 Firth, Neb. 68358

If the draft report is a draft environmental impact statement on this project, please inform us of the review and comment deadlines and such relevant information. Thank you.

Charles J. Griffith

Regional Executive

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1135 N.S. Post Office & Guston House
St. Paul, Minnesota 55101

Soil Conservation Service 316 North Robert Street St. Paul, Minnesota 55101

7 July 1978

Mr. Valdam V. Adamkus
Acting Regional Administrator, Region V
U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

ATTN: Mr. Ronald Mustard

#### Dear Mr. Adamkus:

We appreciate the U.S. Environmental Protection Agency's participation in the 21 June 1978 interagency meeting held at our office. The meeting concerned specific water quality issues associated with a water and related land resource study of the upper Minnesota River subbasins conducted jointly by the Soil Conservation Service and the Corps of Engineers under authorization of Public Law 87-639. A rester of participants and an agenda for the meeting are inclosed.

As a follow-up to discussions at the meeting, we would like the Environmental Protection Agency to furnish a letter stating its acceptance of the following:

- a. The Environmental Protection Agency has approved the State water quality standards and classification of streams in the study area by Minnesota and South Dakota. South Pakota has minimal water quality data on its streams and cannot judge which ones currently meet the classified standards. Minnesota has water quality data on the major streams but information is incomplete for the headwaters. The Environmental Protection Agency and the two States agree that water quality with reservoir project development should equal or exceed the natural condition prior to construction.
- b. The Environmental Protection Agency and the States consider channelisation as a last alternative measure of streamflow control. The National
  Environmental Policy Act and U.S. Department of Agriculture-U.S. Fish and
  Wildlife Service Channel Guidelines are referenced guidelines. The Environnental Protection Agency and the States list temperature as a primary water
  quality parameter. Trout streams are of prime concern and South Dakota transmitted a listing of State trout streams of which six are in the study area
  headwaters. Minnesota lists two trout streams in the study area. South
  Dakota will provide its water plan for study use.

- c. Generally, uses of streams are set by regulation and are not allowed to be changed by project development.
- d. Wet dams with sediment or conservation pools are desirable to the State. The agencies do not enticipate water quality problems with dry dams. However, with both wet and dry dams, impacts will be judged by downstream effects.
- a. The Environmental Protection Agency and the States agree that some wat dams will be sutrephic. This is a concern if reservoirs are in an accelerated rate of sutrephication. The Environmental Protection Agency recommends the use of retention loading curves during design. All of the agencies agree that adverse downstream impacts caused by reservoir discharges would be a violation of water quality standards.
- f. Any developmental beneficial impacts will not be accepted as trade-offs for advance water quality impacts. Full compliance with the water quality standards is the objective. The agencies would respond specifically to actual project plans. They accept mitigation for nonpredictive adverse impacts.
- g. A suggested water quality monitoring program agreed to by the three agencies is as follows:
- (1) Four existing reservoirs, representative of the major land resource areas of the study area, will be monitored as also representative of those prospective sites with 50- to 100-square-mile drainage areas on nearby streams.
- (2) Measurements of the stream inflow, the impoundment, and outflow in the spring will be taken. Monitoring will occur three times in the summer and once during the winter.
- (3) Parameters to be monitored will be agreed upon by the study work group and State agencies. Minnesota desires that sampling for pesticides and herbicides be done at least once a year in all major reservoirs.
- (4) All trout streams will be included in the stream monitoring program.
- h. Predictive medaling is not applicable to the potential reservoir impoundments in the study area.
- i. There are a few situations of possible municipal affluent discharge into potential reservoir impoundments which should be coordinated with local interests for possible improved treatment to remove contaminants.

7 July 1978

Mr. Valdas V. Adamkus

For us to proceed with the water quality study in a timely manner and to advise congressional and local interests of agreements made between the U.S. Environmental Protection Agency, Minnesota Pollution Control Agency, South Dakota Department of Environmental Protection, and Corps of Engineers on the water quality issues, we would appreciate your direct response to this letter by 4 August 1978. Should you have any questions, please contact us. Nr. Peter Fischer, Chief, Hydraulic Engineering and Foundation Materials Branch (612-725-7567), or Mr. Robert Northrup, Chief, Ceneral Investigations Section (612-725-7559), can provide additional information.

#### Sincerely,

2 Incl As stated HARRY M. MAJOR

State Conservationist Soil Conservation Service WALTER L. HEME Lieutement Colonel, CE Acting District Engineer

CF: Mr. Kaith L. Beseke Western District Office U.S. Environmental Protection Agency 7401 Lyndale Avenue South Minneapolis, Minnesota 55423

# UPPER MINNESOTA RIVER SUBBASINS STUDY - WATER QUALITY MEETING WITH SCS, COFE, EPA, MPCA, SOUTH DAKOTA 21 JUNE 1978

NAME	AGENCY	POSITION OR TITLE
Stan Kummer	Corps of Engineers	Study Cochairman
Dan Hartmann	Corps of Engineers	Water Quality Unit
Lanny Peissig	Minnesota Pollution Con- trol Agency	Section of Surface & Groundwater
Laurel Lappegaard	Soil Conservation Service	Study Cochairman
Dan Reinartz	Corps of Engineers	Water Quality Unit
Ordean Finkelson	Soil Conservation Service	Water Quality Unit
Ray Cope	Soil Conservation Service	W.Q. Spec., MTSC, Lincoln, NE.
Bill Franz	Environmental Protection Agency	Environmental Protection Specialist
Lee Baron	South Dakota Department of Environmental Protection	Water Quality Program
Duane Murphey	South Dakota Department of Environmental Protection	Water Quality Section Chief
Ken Krug	Soil Conservation Service	River Basin-Watersheds- St. Paul
Albert Griffiths	South Dakota Department of Agriculture	State Liaison
Gary G. Rott	Minnesota Pollution Con- trol Agency	Surface and Groundwaters Section
Robert Northrup	Corps of Engineers	Chief, General Investigations Section

#### **AGENDA**

## UPPER MINNESOTA RIVER SUBBASIN STUDY CORPS OF ENGINEERS AND SOIL CONSERVATION SERVICE WATER QUALITY ISSUES

#### 2 1 JUN 1978

9:30 A.M.	Introductory Remarks	Stan Kummer
	Study Background	Laurel Lappegard
•	Slide Presentation	Stan Kummer
11:00 A.M.	Specific Issues and Questions	Group Discussion
12:00 Noon	Lunch	
1:00 P.M.	Corps of Engineer Reservoirs	Dan Hartmann
	Soil Conservation Service Reservoirs	Ordean Finkleson
1:45 P.M.	Water Quality Sampling Program	Group Discussion
4:00 P.M.	Summary	Stan Kummer

St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Hinnsota 55101

Soil Conservation Service 316 North Robert Street St. Paul, Minnesota 55191

7 July 1978

No. Sandra Gardebring Executive Director Minnesota Pollution Control Agency 1935 West County Road B-2 Roseville, Minnesota 55113

Dear Me. Gardebrings

We appreciate the participation of the Minnesota Pollution Control Agency in the 21 June 1978 interagency meeting held at our office. The meeting concerned specific veter quality issues associated with a water and related land resources study of the upper Minnesota River subhasius conducted jointly by the Soil Conservation Service and the Corps of Engineers under authorization of Public Law 67-639. A roster of participants and an agenda for the useting are inclosed.

As a follow-up to discussions at the meeting, we would appreciate a latter stating the Missessta Pollution Control Agency's acceptance of the following:

- a. The Environmental Protection Agency has approved the State water quality etendards and classification of streams in the study grea by Minnesota and South Dakota. South Dakota has minimal water quality data on its streams and cannot judge which once currently meet the classified standards. Minnesota has water quality data on the major streams but information is incomplete for the hadroters. The Environmental Protection Agency and the two States agree that veter quality with recorver project development should equal or exceed the natural candition prior to construction.
- b. The Environmental Protection Agency and the States consider channelization as a last alternative measure of streamflow control. The Sational Environmental Policy Act and U.S. Department of Agriculture-U.S. Vish and Wildlife Service Channel Guidelines are referenced guidelines. The Environmental Protection Agency and the States list temperature as a primary water quality persenter. Treat streams are of prime concern and South Dakota transmitted a listing of State treat streams of which six are in the study area beadwaters. Himnesota lists two treat streams in the study area. South Dakota will provide its vator plan for study use.

- c. Generally, uses of streams are set by regulation and are not allowed to be changed by project development.
- d. Wet dams with sediment or conservation pools are desirable to the State. The apencies do not anticipate water quality problems with dry dams. However, with both wet and dry dams, impacts will be judged by downstress effects.
- e. The Unvironmental Protection Appenry and the States agree that some wet dams will be entrophic. This is a concern if reservoirs are in an accelerated rate of entrophication. The Environmental Protection Alency recommends the use of retention loading curves during design. All of the agencies agree that adverse downstream impacts caused by reservoir discharges would be a violation of water quality standards.
- f. Any developmental beneficial impacts will not be accepted as trade-offs for adverse water quality impacts. Full compliance with the water quality standards is the objective. The appecies would respond specifically to actual project plans. They accept mitigation for nonpredictive adverse impacts.
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- h. Predictive modeling is not applicable to the potential reservoir impoundments in the study area.
- i. There are a few situations of possible municipal effluent discharge into potential reservoir impoundments which should be coordinated with local interests for possible improved treatment to remove contaminants.

No. Sandra Gardebring

7 July 1973

For us to proceed with the water quality study in a timely manner and to advise congressional and local interests of agreements made between the U.S. Environmental Protection Agency, Minnesota Pollution Control Agency, South Takota Department of Environmental Protection, and Corps of Engineers on the water quality issues, we would appreciate your direct response to this letter by 4 August 1978. Should you have any questions, please contact us. Are Peter Fischer, Chief, Bydraulic Engineering and Poundation Materials Branch (612-725-7567), or Mr. Robert Morthrup, Chief, General Investigations Section, (612-725-7559), can provide additional information.

#### Sinceraly,

2 Incl As stated HARRY M. MAJOR State Conservationist Soil Conservation Service

WALTER L. HEM: Lieutenant Colonel, CE Acting District Engineer

CF:

Mr. Lonny Peissig Water Quality Division Minnesota Pollution Control Agency 1935 West County Road B-2 Reserville, Minnesota 55113

Mr. Gary G. Rott Water (Mulity Division Minnesota Pellution Central Agency 1915 West County Head N-2 Minnesota 55113 DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesots 55101

DEPARTMENT OF AGRICULTURE Soil Conservation Service 316 North Robert Street St. Paul, Minnesota 55101

7 July 1978

Nr. Albert Griffiths
Director
Division of Conservation
South Dakota Department of Agriculture
Anderson Building
Pierre, South Dakota 57501

Dear Mr. Griffiths:

We appreciate the participation of the South Dekota Department of Environmental Protection in the 21 June 1978 interagency meeting held at our office. The meeting concerned specific water quality issues associated with a water and related land resources study of the upper Minnesota River subbasins conducted jointly by the Soil Conservation Service and the Corps of Engineers under authorization of Public Law 87-639. A roster of participants and an agenda for the meeting are inclosed.

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- a. The Environmental Protection Agency has approved the State water quality etandards and classification of streams in the study area by Minnesota and South Dakota. South Dakota has minimal water quality data on its streams and cannot judge which ones currently meet the classified standards. Minnesota has water quality data on the unjor streams but information is incomplete for the headwaters. The Environmental Protection Agency and the two States agree that water quality with reservoir project development should equal or exceed the natural condition prior to construction.
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7 July 1978

#### ir. Albert Griffiths

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#### Mr. Albert Oriffithe

7 July 1978

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#### Sincerely,

2 Incl As stated MARKE M. MAJOR State Conservationist Soil Conservation Service WALTER L. HEME Lieutenent Colonel, CE Acting District Engineer

CF:
Dr. Allyn Lockner
Secretary
South Dakota Separtment of Environmental Protection
Pierro, South Dakota 57501

#### Attendance List

#### Advisory Committee Tour

UMRS (639 Study) July 27, 1978

Name	Organization	Location
Federal Agencies		
Laurel Lappegaard Stan Kummer Jim Ruone Mel Niehaus Dave Browning Larry Schmidt Keith Roble Dennis Holme Tom Fischer Ivan Wilkinson Paul Nielsen Nancy B. Walters Jon DeGroot William Stokes Harry Major	SCS - USDA Corps of Engineeers UMREC SCS - USDA SCS - USDA SCS - USDA SCS - USDA Corps of Engineers SCS - USDA SCS - USDA SCS - USDA SCS - USDA SCS - USDA U.S. Fish & Wildlife Service SCS - USDA SCS - USDA SCS - USDA SCS - USDA	St. Paul, MN St. Paul, MN Minneapolis, MN Ivanhoe, MN Ivanhoe, MN Marshall, MN St. Paul, MN Marshall, MN St. Paul, MN Lincoln, NE St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN
Dan Peinartz	Corps of Engineers	St. Paul, MN
State Agencies (MN) & other Arnold Onstad Tom Kalitowski Jack Ditmore Michael Sobota Carl M. Johnson	SMRBB MN Water Planning Board MN Water Planning Board Southwest RDC SMRBB	Spring Grove, MN St. Paul, MN St. Paul, MN Slayton, MN St. Peter, MN
Elvin Tews Bob Overley Thomas Kucera Robert Kirsch Marylyn Deneen Earl Huber Hedia Rieke Marilyn Lundberg Leonard Pikal	MDNR Upper MN Valley RDC DNR - Fish & Wildlife MN DNR - Eclogical Serv. Sec. Soil & Water Conv. Board MDNR (Ecological Services) MDNR SMRBB Soil & Water Conv. Board	Spicer, MN Appleton, MN St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN St. Paul, MN
Minnesota Legislature  Jim Nichels Jerome O. Gunderson	MN Senate MN State Senator	Lake Benton, MN Mabel, MN
Local Officials  Milo C. Hanson Linda Lensing Gloria Pearson Willie Beecher John Boulton	Area V Director Lac qui Parle Yellow Bk. WS Dis Area II Secretary Lac qui Farle Yellow Bk. WS Dis Area II Treas.	Dawson, MN

#### State Agencies - South Dakota)

Lee BaronSo. Dak. Dept. Environ. Prot.Pierre, So. Dak.Leo RitterSo. Dak. Nat. Res. Dev.Pierre, So. Dak.Ray ChristensenSo. Dak. Dept. of AgriculturePierre, So. Dak.John KirkSo. Dak. WPFPierre, So. Dak.

#### Environmental Organizations

Alan Wentz Representing National Audabon Society Brockings, So. Dak.

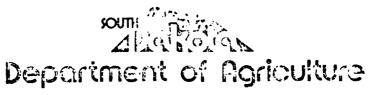
John Gallagher National Audubon Society Jamestown, No. Dak.

#### Other

Maxine Gunderson Mabel, MN

### UPPER MINNESCTA RIVER SUBBASINS IMPLEMENTATION STUDY (PUBLIC LAW 87-639) CORPS OF ENGINEERS AND SOIL CONSERVATION SERVICE

PERSONMEL INVOLVED	Telephone Number	
STUDY ADVISORY COMMITTEE Chairperson Arnold Onstad, Chairperson Southern Minnesota		
River Easin Board  George Bekeris, Area Manager, U.S. Fish & Wildlife Service		498 <b>-</b> 5323 725 <b>-</b> 7131
Colonel Forrest T. Gay, III, District Engineer		
St. Paul District, Corps of Engineers Tom Kalitowski, Minnesota Water Planning Board		725 <b>-</b> 7501 296 <b>-</b> 1424
Harry Major, Minnesota State Conservationist, Soil Conservation Service		725-7675
Willard Pearson, Chairperson - Area II Action Committee	(612)	769 <b>–</b> 4515
SOIL CONSERVATION SERVICE  Jon DeGroot, Assistant State Conservationist  Ivan Wilkinson, River Basin Watershed Flanning Staff Leader	(612) (612)	725 <b>-</b> 7684 725 <b>-</b> 7682
Laurel K. Lappegaard, Study Cochairman Tom Fischer, Area Conservationist, Marshall, Minnesota	(612)	725 <b>-</b> 7158 532 <b>-</b> 2240
CORPS OF ENGINEERS		
Robert Northrup, Chief, General Investigations Section, Planning Branch	(612)	725 <b>-7</b> 559
Stan Kummer, Study Cochairman		725-7601
U.S. FISH AND WILDLIFE SERVICE  Nancy Bannister, Study Group Representative	(612)	725-7131
MINNESOTA WATER PLANNING EOARD  Jack Ditmore, Administrative Asistant	(612);	296-1424
MINNESOTA DEPARTMENT OF NATURAL RESOURCES Hedia Rieke, Study Group Representative	(612)	296-4800
AREA II ACTION COMMITTEE		
Chairperson Willard Pearson, President, Lac qui Parle Watershed District	(612)	769-4515
John Boulton, President, Yellow Medicine River Watershed District	(507)	296-4668
Torgny Anderson, Retired Chairperson, Lyon County Foard Jerry Siegel, Manager, East Dakota Conservancy District Roy Syverson, Chairperson, Redwcod County Board		
SCUTHERN MINNESOTA RIVERS BASIN BOARD Marilyn Lundberg, Administrative Assistant	(612)	296-0676
SOIL AND WATER CONSERVATION BOARD Vern Reinert, Executive Director , Engineer	(612)	296-3767
SOUTH DAKOTA - NATURAL RESOURCES Albert Griffiths (Contact Ferson)	(605)	773-3258
MINNESOTA POLLUTION CONTROL AGENCY - DIVISION OF WATER QUALITY		
Lanny R. Peissig, Division Head - Cary Rott	(012)	296-7242
ENVIRONMENTAL PROTECTION AGENCY (EPA) William Franz, EPA, Chicago, Illinois Keith Beseke, EPA, Minneapolis Office		353 <b>-</b> 2307 <b>725-</b> 3272



#### **DIVISION OF CONSERVATION**

Anderson Building, Room 322

Pierre, South Dakota 57501

**Phone 605/224/3258**Phone 605/773-3258

July 19, 1978

Mr. Stan Kummer, Study Coordinator Department of the Army St. Paul District, Corp of Engineers St. Paul, Minnesota 55101

Dear Stan,

This is the only response obtained to date concerning July 7, 1978 correspondence.

We hope that this communication helps to clarify various positions of South Dakota relating to the Upper River Sub-Basin Study.

Šincerely,

Albert L. Griffiths, Director

Division of Conservation

# Care Color of Middle Communical Protection

Pierre, South Dakota 57501 Phone (601) 224-3351

July 14, 1978

Al Griffiths, Director Division of Conservation South Dakota Department of Agriculture Anderson Building Pierre, South Dakota 57501

Dear Al:

We have reviewed the copy of the letter dated July 7, 1978, from the Soil Conservation Service and Corps of Engineers to you concerning the meeting held June 21, 1978, to discuss the Minnesota River Sub-Basin implementation study. We agree with their comments A through H with the following comments and exceptions:

RECEIVED

.UUL!1 8:1972

Soura Dakota Division of Conservation

Item C should be modified to read "gen ly uses of the stream are set by regulation and are not allowed to be domigraded by project development. In those cases where a project development would allow higher beneficial uses, those uses would be considered for adoption by the Board of Environmental Protection.

Item D. Statements about wet and dry dams are generalizations. There may be specific situations where certain dams may be undesirable. That will be determined on a case-by-case basis at a later date by reviewing proposed sites and designs.

Item G(1). Four reservoirs are the suggested number to be representative of prospective sites. It should not be considered a firm number. We believe that anywhere from three to six could be considered adequate.

Item G(2). As we discussed at the meeting, monitoring four times a year at these sites may be adequate to represent the conditions in the impoundment and the outflow. A reservoirs inflow may be highly variable. It fill probably be necessary for a more frequent sampling analysis on these tributary inflows. In those cases where the inflow occurs only after spring melt or rainfall events, it may be necessary to have someone either on-site or very near to sample during or shortly after those events.



Equal Opportunity Imployer

To date we have been pleased with the actions taken by the Corps of Engineers and Soil Conservation Service regarding this study.

Should you or they have any further questions regarding the understanding of our policies or design and implementation of the monitoring, please contact us as soon as possible.

Sincerely,

Allyn D. Jockner, Secretary Department of Environmental Protection

C4/13



## Minnesota Pollution Contro! Agency

August 8, 1978

Mr. Harry M. Major State Conservationist Soil Conservation Service 316 North Robert Street St. Paul. Minnesota 55101

Lieutenant Colonel Walter Heme Acting District Engineer St. Paul District, Corps of Engineers 1135 U.S. Post Office and Custom House St. Paul, Minnesota 55101

Dear Mr. Major and Lieutenant Colonel Heme:

Reference is made to your July 7, 1978 letter concerning specific water quality issues associated with a water and related land resources study of the Upper Minnesota River.

Our Agency is basically in agreement with the material provided in that letter except for item (h). It is felt that predictive modeling is an applicable and useful tool which can be used to predict environmental impacts if other forms of analysis such as retention - loading curves, as identified in your letter, are found to be inadequate. The methods of assessment selected need to adequately identify potential water quality problems so that these problems can be evaluated and minimized. Therefore, as the assessment procedure progresses, it may become evident that more intense work will be needed in selected areas.

The following additional information is also provided. Dams should be adequately designed so that they do not reduce the water quality or low flow in the waterway. Minnesota has two trout streams affected by the proposed dams. They are Canby Creek and the Redwood River between Russel and Lynd in Lyon County. There are four other trout streams in the study area; Ten Mile Creek in Lac Qui Parle County, Ramsey Creek in Redwood County, Hindeman Creek in Brown County, and John's Creek in Brown County. Our Agency also has some concern with the impacts of dry dams on water quality.

Phone: 612/296-7301

1935 West County Road B2, Roseville, Minnesota 55113 Regional Offices - Duluth Brainferd Detroit Lakes/Marshall/Rochester Mr. Harry M. Major Lieutenant Colonel Walter Heme Page 2 August 8, 1978

It is felt that it would be beneficial to do an evaluation of an existing dry dam to determine environmental impacts. When studies of existing impoundments are conducted, flow and water quality should be measured at the same time so that loadings can be calculated. It is also recommended that pesticide and herbicide monitoring be conducted when these chemicals are being applied to the farmland.

If you have any questions, please feel free to contact me.

Yours truly,

Sandra S. Gardebring Executive Director

SSG:jw

